U.S. DEPARTMENT OF THE INTERIOR

OFFICE OF WATER RESEARCH AND TECHNOLOGY

SELECTED WATER RESOURCES ABSTRACTS

VOLUME 13, NUMBER 11
JUNE 1, 1980

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SELECTED WATER RESOURCES ABSTRACTS

A semimonthly publication of the
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VOLUME 13, NUMBER 11
JUNE 1, 1980

W80-03601 -- W80-03900

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most our our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographic citation and a set of identifiers or descriptors which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Office of Water Research and Technology.

To provide SWRA with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

The input from these Centers, and from the 54 Water Resources Research Institutes administered under the Water Research and Development Act of 1978, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies becomes the information base from which this journal is derived.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Office of Water Research and Technology
U.S. Department of the Interior
Washington, D.C. 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1A. Properties

AN ANALYSIS OF THE IRREVERSIBLE THERMODYNAMICS MODEL FOR COUPLED HEAT AND MOISTURE TRANSPORT PHENOMENA IN UNSATURATED POROUS MEDIA,
Arkansas Univ., Fayetteville. Dept. of Chemical Engineering.
J. A. Havens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149321, Price codes: A06 in paper copy, A01 in microfiche. Arkansas Water Resources Research Center University of Arkansas Publication No 67, Project Completion Report, January, 1980. 122 p, 42 Fig, 4 Tab, 111 Ref, 1 Append. OWRT A-042-ARK(2).

Descriptors: *Mathematical models, *Thermodynamic behavior, *Heat transfer, *Water temperature, Thermodynamics, Moisture content, Transfer, Model studies, Water transfer, Volumetric analysis, Gravimetric analysis, Porous media, Saturation.

The coupled heat and moisture transfer equations of the Irreversible Thermodynamics (IT) theory, attributed to Cary and Taylor, were numerically interpreted to predict steady-state temperatures and moisture content profiles for a sealed unsaturated system. The system was a one-dimensional spherical unit of distilled water-unsaturated glass beads (210 to 298 microns) that was subjected to known heat flux rates. Model predictions were compared with measured moisture and temperature profiles from an experimental investigation. Model development is discussed including the thermodynamics of irreversible processes, transport equations, solution techniques, and measurement of transport coefficients. For the experimental investigation two concentric spheres were mounted on a support stand with a heater encased in the inner sphere. This entire system was enclosed in a constant temperature air bath. Thermocouples and a potentiometric recorder were used to monitor temperatures. Gravimetric analyses of samples extracted from three locations were used to measure moisture content. Eleven experimental runs were performed and analyzed and profiles of the results are given. Comparison of these data with model predictions show the validity of the IT approach. The moisture content gradient to heat flux coupling coefficient was small and a negligible heat flux was associated with the moisture content gradient. A brief historical and literature review is included. (Seigler-IPA)
W80-03639

STRUCTURAL CONTROLS OF HOT-SPRING SYSTEMS IN SOUTHWESTERN MONTANA,
Montana State Univ., Bozeman; and Geological Survey, Helena, MT. Water Resources Div.
R. A. Chadwick, and R. B. Leonard.
Available from: OFSS BX 25425, Fed. Ctr. Denver CO printed copy $3.50 microfiche $3.50. Geological Survey open-file report 79-1333, September 1979. 25 p, 4 Fig, 1 Tab, 53 Ref.

Descriptors: *Structural geology, *Hot springs, *Montana, *Geothermal studies, *Faults(Geologic), Thermal water, Thermal springs, Fractures(Geologic), Rocks, Conduits, Aquifers, Water temperature, *Southwest Montana.

Thermal waters that issue as hot (more than 38C) springs in southwestern Montana appear to circulate to depth along Cenozoic block faults, deep fractures penetrating the dominantly crystalline rock crust, or major structural lineaments. At individual hot springs, rising thermal waters are transmitted along conduits formed by the intersection of a major fault with other faults, fracture zones, anticlinal axes (which may be faulted or fractures), or sedimentary aquifers. Step faults and other intra-valley faults may influence circulation at some springs. At others, fracture zones alone may provide the necessary vertical permeability. Normal regional heat apparently is sufficient to maintain the hydrothermal systems without enhancement from cooling igneous bodies. The thermal gradient normally is higher in low thermal conductivity sediments of the block-fault valleys than the 30C per kilometer average for crystalline rock. To attain reservoir temperatures of 60 to 120C indicated by chemical geothermometers, waters would have to circulate to depths of about 2 to 4 kilometers in crystalline rock and about 1 to 2 kilometers in valley sediments. (Kosco-USGS)
W80-03760

2. WATER CYCLE

2A. General

AN INTERIM REPORT ON THE INTENSIVE RIVER-QUALITY ASSESSMENT OF THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA.
For primary bibliographic entry see Field 5B.
W80-03609

EROSION POTENTIAL ASSESSMENT FOR THE WILLAMETTE RIVER BASIN, OREGON,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
For primary bibliographic entry see Field 7C.
W80-03613

OPTIMIZATION OF UNIT HYDROGRAPH DETERMINATION,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-03617

METHODS OF ESTIMATING SOME POSSIBLE INTERACTIONS OF AGRICULTURAL DEVELOPMENT AND WATER RESOURCES IN ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
J. D. Fox, Jr., and J. D. LaPerriere.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-152853, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 77-22-B, January 1980. 14 p, 16 Ref. OWRT A-062-ALAS(1), 14-34-0001-8002.

Descriptors: *Alaska, *Model studies, *Environmental effects, *Land clearing, *Agriculture, Barley, Water quality, Water pollution, Fertilizers, Irrigation effects.

Currently, some 53,000 acres of land in the Clearwater Creek watershed (near Delta Junction, Alaska) are being cleared for intensive barley production. Several uncertainties exist with respect to crop water balance, pesticide and fertilizer transport, and effects of irrigation on groundwater and stream levels. Furthermore, there is a general sparcity of site-specific data. This project was to investigate the utility of modeling and simulation to estimate possible interactions of water resources and agricultural development. Many models proved inappropriate for the environmental extremes of Alaska. In addition, excessive time, money and effort were often required to transfer large, comprehensive models from other parts of the country into working tools for this project. An alternative approach using specific, problem-oriented models written in CSMP language proved useful, as well as a mathematically simple water balance accounting model. These models were applied to specific questions of crop water balance and leaching for the Delta-Clearwater project area. Field data were collected on crop water use and also on benthic algae and macroinvertebrates of Clearwater Creek. General guidelines on data collection and utilization were established to aid state agencies charged with monitoring and managing agricultural development.
W80-03711

THE GEOMORPHOLOGIC STRUCTURE OF HYDROLOGIC RESPONSE,
Universidad Simon Bolivar, Caracas (Venezuela).
I. Rodriguez-Iturbe, and J. B. Valdes.
Water Resources Research, Vol 15, No 6, p 1409-1420, December 1979. 8 Fig, 14 Ref.

Descriptors: *Watersheds(Basins), *Geomorphology, *Rainfall, *Runoff, *Model studies, Mathematical models, Hydrologic properties, Rainfall-runoff relationships, Streamflow, Hydrographs, Unit hydrographs, Synthetic hydrology, Hydrology, Hydrologic response, Geomorphic structure.

A unifying synthesis of the hydrologic response of a catchment to surface runoff was attempted by linking the instantaneous unit hydrograph (IUH) with the geomorphologic parameters of a basin. Equations of general character were derived which express the IUH as a function of Horton's numbers R sub A, R sub B, and R sub L; an internal scale parameter L sub omega; and a mean velocity of streamflow nu. The IUH is time varying in character both throughout the storm and for different storms. This variability is accounted for by the variability in the mean streamflow velocity. The underlying unity in the nature of the geomorphologic structure is thus carried over to the great variety of hydrologic responses that occur in nature. An approach was initiated to the problem of hydrologic similarity. (Sims-ISWS)
W80-03743

HYDROLOGIC DATA FOR WELLS, SPRINGS, AND STREAMS IN BOULDER COUNTY, COLORADO,
Geological Survey, Lakewood, CO. Water Resources Div.
D. C. Hall, E. L. Boyd, and D. Cain.
Available from: OFSS BX 25425, FED. CTR. Denver, CO printed copy $16.00 microfiche $4.00. Geological Survey open-file report 79-979, November 1979. 106 p, 7 Fig, 1 Plate, 5 Tab, 4 Ref.

Descriptors: *Hydrologic data, *Data collections, *Colorado, *Groundwater, *Surface waters, Wells, Springs, Streams, Water quality, Sampling, Sites, Water temperature, Streamflow, Water analysis, Sewage treatment, *Boulder County(Colo).

Hydrologic data collected in 1975-77 as part of a comprehensive water-resources investigation of Boulder County, Colo., by the U.S. Geological Survey in cooperation with the Boulder County Health Department and the Colorado Geological Survey are presented in this report. The data, in tabular and graphic form, consist of water-quality analyses of selected constituents and geohydrologic-site, water-treatment, and sewage-treatment data for 609 wells and 48 springs; water-quality analyses for 102 of the wells and 9 of the springs; water-quality analyses of streamflow from 34 sites; and specific conductance and water-temperature measurements of streamflow from 3 sites. State and local officials in Boulder County may find these data useful in planning for residential, commercial, and industrial development. (Kosco-USGS)
W80-03757

WATER-QUALITY ASSESSMENT OF THE L'ANGUILLE RIVER BASIN, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
For primary bibliographic entry see Field 5B.
W80-03758

THE RELEASE OF REACTIVE PHOSPHATE BY A POSIDONIA AUSTRALIS SEAGRASS COMMUNITY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
H. Kirkman, F. B. Griffiths, and R. R. Parker.
Aquatic Botany, Vol 6, No 4, p 329-337, August 1979. 2 Fig, 1 Tab, 5 Ref.

Descriptors: *Phosphates, *Rooted aquatic plants, *Estuarine environments, *Seagrass, *Port Hacking, Australia, Submerged plants, Posidonia australis, Estuaries, Detritus, Phosphorus compounds, Nutrients, Plant physiology, Water chemistry, Biochemistry, Leaves, Epiphytes, Tides, Diffusion, Metabolism.

Group 2A—General

Reactive phosphate is released into water over the seagrass Posidonia australis in a sunken river valley South West Arm of Port Hacking, Australia, both day and night; the reactive phosphate enters the water column either by diffusion or tidal flow mechanisms. No release occurs over surrounding unvegetated areas. A series of experiments were conducted to determine if Posidonia plants were the agents by which reactive phosphate was moved from interstitial substrate water to the water column. Two 1 sq m aluminium boxes without tops or bottoms were placed over seagrass beds. Each box enclosed about 330 Posidonia shoots. Plants in one box were individually enclosed in plastic bags so that the water in the bags did not mix with water in the box. Water samples were taken at 15 min intervals over 24 hours. Box experiments show simil increases in reactive phosphate for both covered and uncovered plants. Thus Posidonia plants are not responsible for phosphate release. It is postulated, instead, that the seagrass bed releases reactive phosphate through microbiological remineralization of detritus accumulation from the water column, seagrass leaves and epibiota. Release rates vary 0.055-0.17 micro g - at P/h g leaf dwt. (Harris-Wisconsin)
W80-03808

2B. Precipitation

STATISTICAL ANALYSIS OF HYDROLOGIC CRITICAL DROUGHTS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydrology and Water Power.
For primary bibliographic entry see Field 2E.
W80-03618

FORECASTING STORM RAINFALL OVER BHAGIRATHI CATCHMENT DUE TO DEPRESSIONS/CYCLONIC STORMS,
Meteorological Office, New Delhi (India).
G. R. Gupta, K. K. Srivastava, H. C. Mehra, and T. C. Jasra.
Mausam, Vol 30, No 1, p 139-156, January 1979. 7 Fig, 7 Tab, 4 Ref.

Descriptors: *Storms, *Rainfall, *Forecasting, *Floods, Flood forecasting, Precipitation(Atmospheric), Watersheds(Basins), Rain gages, Networks, Weather, Climatology, Meteorology, *India, *Bhagirathi River(India).

Synoptic typing of systems contributing rainfall in catchment areas were found to be a useful technique in quantitative precipitation forecasting. This paper contained detailed analysis of 68 rainstorm situations with one-day rainfall of 2.5 cm or more over the Bhagirathi catchment during the period 1901-1967 in association with depressions/cyclonic storms. An attempt was made in this paper to: (1) estimate the contribution of rainfall over the catchment vis-a-vis the location of the system; (2) estimate the intensities of the rainfall vis-a-vis the intensities of the causative systems, namely depressions/cyclonic storms; (3) determine the time interval between the origin of the system and its movement to an effective location to cause rainfall over the catchment; (4) make quick assessment of average areal rainfall over the catchment on the basis of rainfall data from selected key stations, using regression equation; and (5) maximize the highest rainstorm of September 26, 1956, by moisture charge method. (Sims-ISWS)
W80-03635

ON THE ASSESSMENT OF CROP DROUGHTS: A CASE STUDY FOR DISA (GUJARAT),
Meteorological Office, Poona (India).
S. Venkataraman.
Mausam, Vol 30, No 1, p 123-128, January 1979. 1 Fig, 4 Tab, 10 Ref, 1 Append.

Descriptors: *Droughts, *Crops, *Evapotranspiration, *Rainfall, Soil moisture, Evaporation, Arid lands, Climatology, Agroclimatology, Agriculture, Meteorology, *India.

The comparative nature of meteorological drought studies was pointed out. A monthly rainfall-cum-two-layer soil model to arrive at the ratio of actual water transpired by a ground-shading crop to the potential transpiration need was presented. The use of such ratios for characterizing the drought situations for a reasonably parameterized crop was explained. A case study for Disa station in Gujarat was presented. (Sims-ISWS)
W80-03637

DOES PRECIPITATION PATTERN FORETELL GUJARAT CLIMATE BECOMING ARID,
Meteorological Office, Poona (India).
A. Chowdhury, and V. P. Abhyankar.
Mausam, Vol 30, No 1, p 85-90, January 1979. 2 Fig, 5 Tab, 4 Ref.

Descriptors: *Rainfall, *Monsoons, *Analysis, Time series analysis, Climates, Arid climates, Precipitation(Atmospheric), Climatology, *India, *Gujarat State(India).

In recent years on account of the anomalous behavior of southwest monsoon, drought conditions were reported from many parts of the country, Gujarat State in particular. An attempt was made in this paper to determine if Gujarat is turning drier. Southwest monsoon (seasonal) and the annual rainfall series of nearly 70 years were subjected to sophisticated statistical analyses. Rainfall data over Gujarat was found to constitute a random series and did not exhibit presence of trend, cycle, or persistence. The precipitation pattern did not indicate that arid conditions are gradually increasing over Gujarat State. It also was not feasible to anticipate years of poor rainfall from the past occurrences in the rainfall series. (Sims-ISWS)
W80-03638

A RAINFALL SIMULATOR WITH NONREPETITIOUS MOVEMENT OF DROP OUTLETS,
Science and Education Administration, Riverside, CA. Salinity Lab.
W. B. Kleijn, J. D. Oster, and N. Cook.
Soil Science Society of America Journal, Vol 43, No 6, p 1248-1251, November-December 1979. 3 Fig, 1 Tab, 7 Ref.

Descriptors: *Rainfall simulators, *Simulated rainfall, *Equipment, *Laboratory equipment, Rainfall, Precipitation intensity, Particle size, Drops(Fluids), Engineering, Meteorology, Soil science, Drop-size distributions.

Problems encountered in simulating uniform rainfall inside the laboratory were discussed. A new rain simulator was described which eliminates nonuniformity by a non-repeating movement of drop outlets. The model tested applies rain to a ring-shaped area of 0.21 sq m with a coefficient of variation of about 7%. By using drop outlets of different sizes, one also can adjust the raindrop size distribution. (Sims-ISWS)
W80-03726

2C. Snow, Ice, and Frost

HYDRAULIC CONDUCTIVITY OF MOUNTAIN SOILS,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
O. R. Williams, L. Ponce, R. Meiman, and M. Spearnak.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153455, Price codes: A04 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, CO. State Univ., Completion Report No. 92, Sept. 1978. 52 p, 21 Fig, 8 Tab, 31 Ref. OWRT A-032-COLO(1), 14-34-0001-6000.

Descriptors: *Hydraulic conductivity, *Snowmelt runoff, Subalpine watershed, Litterflow, Water conservation, Percolation, *Mountains, Coniferous forest, Forest watersheds, *Soil water movement.

Pathways and rates of delivery of snowmelt runoff from a subalpine conierous forest watershed were studied through the examination of saturated hydraulic conductivity, soil moisture tension and litterflow measurements. Measurements were taken from litterflow collectors and our soil pits 2.5 meters deep located on north and south aspects. During the period of snowmelt, runoff was carried as surface and near-surface flow in the litter layer and upper 4-5 cm of mineral soil. Saturated or near-saturated flow occurred at the base of the soil pits. The majority of the soil profile transmitted soil moisutre as unsaturated flow. Hydraulic conductivity determinations indicated that under saturated conditions the potential percolation through the soil mass would generally be in excess of the normal snowmelt rate.
W80-03775

2D. Evaporation and Transpiration

MEASURING EVAPOTRANSPIRATION OF TURFGRASS,
Colorado State Univ., Fort Collins. Dept. of Agronomy.
C. M. Feldhake.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-152051, Price codes: A04 in paper copy, A01 in microfiche. MS Thesis, 1979. 56 p, 7 Fig, 5 Tab, 26 Ref, Append. OWRT A-043-COLO(1), B-035-WYO(5).

Descriptors: *Evapotranspiration, *Turfgrasses, *Kentucky bluegrass, *Lawns, Lysimeters, Urban lawns, Growth chamber, Canopy temperature, Infrared thermometer, Thermal emissivity.

Evapotranspiration (ET) of Kentucky bluegrass (Poa pratensis L) was measured in urban lawns, in a growth chamber and as part of a study relating canopy temperature to water stress. Lysimeters 30.5 cm in diameter, were used to measure ET. Lack of control over urban lawn sites restricted the reliability of relating ET to microclimate. In the growth chamber study, ET was influenced by day temperature, night temperature, clipping height and soil texture. It was shown that soils high in clay are not desirable for use in lysimeters due to limited root growth. Average midday canopy temperature was more reliable at identifying water stress than daily ET measurements using lysimeters. Canopy temperature measurements, using an infrared thermometer, were utilized without correcting for canopy quality differences since the thermal emissivity of lush, green turf and dead, brown turf was found to be the same. The Barnes 14-220 infrared thermometer was calibrated and it's scale was found to be 8% high for the 0-50C range.
W80-03646

2E. Streamflow and Runoff

TOWARD A CONCEPTUAL FRAMEWORK FOR RIVER-QUALITY TREND AND CAUSE-EFFECT ANALYSIS,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5B.
W80-03611

THERMAL MODELING OF HIGHLY TRANSIENT FLOWS IN THE CHATTAHOOCHEE RIVER NEAR ATLANTA, GEORGIA,
Geological Survey, NSTL Station, MS.
H. E. Jobson, and T. N. Keefer.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 125-141, 1978. 6 Fig, 5 Ref.

Descriptors: *Thermal water, *Model studies, *Georgia, *Rivers, Water temperature, Streamflow, Routing, Mathematical models, Thermal pollution, Heat transfer, Heat balance, Tracers, Calibrations, Flow, Analytical techniques, Unsteady flow, On-site investigations, *Chattahoochee River(GA).

Coupled flow, temperature, and transport models have been developed and verified by use of two extensive sets of data collected under highly unsteady flow conditions on a 27.9 km reach of the Chattahoochee River between Buford and Norcross, Georgia. Existing solution techniques, with

minor improvements, were applied to verify flow and transport modeling concepts. A linear-implicit finite difference flow model was calibrated by use of a depth profile obtained during steady low flow and unsteady flow data obtained during March 1976. The flow model was verified by use of dynamic stage and discharge data obtained in October 1975. The verification results were considered to be very good, particularly for flows of less than 100 cu m/s. Dye was added to the upstream end of the river reach at a constant rate while the river flow was highly unsteady. The transport model closely simulated observed dye concentrations in the river. Even without calibration the temperature model was capable of predicting temperature changes through the reach of as large as 5.8C with a root-mean-square error of 0.32C in October 1975 and 0.20C in March 1976. Hydropulsation has a significant effect on the water temperature below Buford Dam. These effects are very complicated because they are quite dependent on the timing of the release with respect to both the time of day and past releases. (See also W80-03606) (Humphreys-ISWS)
W80-03615

OPTIMIZATION OF UNIT HYDROGRAPH DETERMINATION,
Texas Univ. at Austin. Dept. of Civil Engineering.
L. W. Mays, and L. Coles.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, p 85-97, Proceedings Paper 15129, January 1980. 3 Fig, 5 Tab, 12 Ref, 2 Append.

Descriptors: *Unit hydrographs, *Rainfall, *Runoff, *Optimization, *Mathematical models, Model studies, Hydrographs, Synthetic hydrology, Computers, Computer programs, Linear programming, Precipitation(Atmospheric), Rainfall-runoff relationships, Hydrology.

A linear programming model was developed for the optimal determination of unit hydrographs. The model determines the best unit hydrograph by minimizing the sum of deviation between observed and calculated runoff hydrographs. The principles of linearity and superposition of unit hydrograph theory are the basis of the model. Several multi-period rainfall events can be considered simultaneously for the optimal unit hydrograph determination. The model was tested using both hypothetical and actual rainfall events. (Sims-ISWS)
W80-03617

STATISTICAL ANALYSIS OF HYDROLOGIC CRITICAL DROUGHTS,
Technical Univ. of Istanbul (Turkey). Dept. of Hydrology and Water Power.
Z. Sen.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15134, p 99-115, January 1980. 16 Fig, 3 Tab, 8 Ref, 2 Append.

Descriptors: *Droughts, *Stochastic processes, Statistical methods, Probability, Statistics, Markov processes, Analytical techniques, Analysis, Rivers, Flow, Hydrology, *Statistical analysis, Random variables.

Analytical formulations of critical droughts either as longest drought duration or maximum deficit sum were derived by making use of the theories of random number of random variables and runs. The results obtained are valid for independent and lag-one Markov processes only. The numerical solution of derived analytical expressions yields any order of statistical moments, the most important one is the expected value of critical droughts. It was quantitatively observed that the drought duration and severity are dependent on the correlation structure, sample size, and truncation level. (Sims-ISWS)
W80-03618

ON THE CALCULATION OF THE WIDTH AVERAGED FLOW DUE TO LONG WAVES IN AN OPEN CHANNEL,
Victoria Univ. of Manchester (England). Simon Engineering Labs.
T. J. Smith, and H. S. Takhar.
Journal of Hydraulic Research, Vol 17, No 4, p 329-340, 1979. 7 Fig, 22 Ref.

Descriptors: *Turbulent flow, *Estuaries, *Turbulent boundary layers, Hydraulics, Waves(Water), Open channel flow, Open channels, Velocity, Equations, Shear, Stress, Mathematical models, Analytical techniques, Analysis, Laboratory tests, Flow, *Turbulence energy closure models, Width-average flow, Long waves.

This paper described the use of mean turbulence energy closure models for the calculation of the vertical structure of the width-averaged flow due to the propagation of long waves in an open channel of constant width and rectangular cross section. Two turbulence models were considered which required the solution of one or both of the differential equations governing the turbulence energy and its dissipation rate. Numerical solutions were obtained for the motion induced by long waves in a laboratory channel and in the Humber Estuary. The computed values of surface velocity and bed shear stress in the laboratory channel were found to agree well with observed values. The calculation procedure also accurately reproduced the vertical structure of the tidal flow in the Humber Estuary. Existing theoretical relationships for the bed shear stress under long waves were verified by the numerical calculations, and a distribution of the dissipation length scale, postulated on physical grounds, was also confirmed. It was concluded that turbulence models of this type represent powerful research tools for the study of long waves, especially those which occur in nature. (Lee-ISWS)
W80-03619

MEASUREMENTS OF COMBINED OSCILLATORY AND STEADY FLOW OVER A ROUGH BED,
MacDonald (Sir M.) and Partners, Cambridge (England).
For primary bibliographic entry see Field 8B.
W80-03620

TURBULENCE MEASUREMENTS IN THE BOUNDARY LAYER OVER A SAND WAVE FIELD,
Washington Univ., Seattle. Dept. of Oceanography.
S. R. McLean, and J. D. Smith.
Journal of Geophysical Research, Vol 84, No C12, p 7791-7808, December 20, 1979. 17 Fig, 5 Tab, 22 Ref. DOE EY-76-S-06-2225 TA 25, NSF GA14178.

Descriptors: *Turbulence, *Sand waves, *Rivers, *Columbia River, Measurement, Current meters, Flow, Beds under water, River beds, Stress, Streamflow, Boundary layers, Data processing, Analytical techniques, Hydrology, Power spectra.

To assist in elucidating the turbulent structure of flow over regular sets of bed forms, data procured with small mechanical current meters above 2 m high, 96 m long sand waves in the Columbia River were analyzed. The high frequency resolution of the flow sensors and the half hour records that were collected with them were shown to be sufficient to yield reliable Reynolds stresses. In addition, an expression from which the sampling error in Reynolds shear stresses can be estimated from the sampling frequency, the local flow speed, and the distance from the boundary was presented. Although the kappa to the (-5/3) power region of the energy spectrum was found, the conditions for isotropy were not satisfied anywhere within the measured band. Spatial structure of the Reynolds stress components was found to be complicated in character but explicable in basic fluid mechanical terms. Owing to the near boundary effects of form drag induced by the sand waves, the spatially averaged shear stress increased from 20 dyn/sq cm at 35 cm to 40 dyn/sq cm at 100 cm. Furthermore, the Reynolds shear stress was found to vary with the structure of the variance of the vertical velocity component rather than with that of turbulent kinetic energy as assumed in the simple closure models that have been used so far in theories for flow over such bed forms. (Sims-ISWS)
W80-03626

HYDRAULICS OF FLOW IN THE KASKASKIA RIVER, ILLINOIS,
Illinois State Water Survey, Urbana.
N. G. Bhowmik.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153448, Price codes: A06 in paper copy, A01 in microfiche. ISWS Report of Investigation 91, 1979. 116 p, 73 Fig, 13 Tab, 46 Ref, 2 Append.

Descriptors: *River flow, *Flow characteristics, *Illinois, *On-site investigations, Open channel flow, Streambeds, Data collections, Low flow, Roughness(Hydraulic), Head loss, Hydraulics, Meanders, On-site tests, Geomorphology, Particle size, Bottom sediments, Velocity, Flow profiles, Spatial distribution, Water circulation, Discharge(Water), Analytical techniques, Analysis, *Kaskaskia River(IL), Pools, Riffles, River bends.

The hydraulics of flow was investigated at two reaches in the Kaskaskia River. Hydraulic data were collected for 58, 1040, 1420, and 4000 cfs from Reach 1 below Lake Shelbyville and for 290, 2160, and 3700 cfs from Reach 2 below Carlyle Lake. The flow frequencies varied from 5 to 88%. In all, 79 bed and bank material samples were collected and analyzed to determine the particle size distribution. In all cases, the flow can be approximated by uniform flow equations. Head loss varied from 0.96 ft/mile for high flows to 1.98 ft/mile for low flows. The vertical velocity distribution was found to follow a logarithmic distribution. The average velocity at 0.5 foot above the bed was approximately 95% of the average velocity in the cross section. Altogether 79 isovels, or lines of equal velocity, in the cross sections were developed on the basis of the hydraulic data collected in the field. The ratio of the maximum velocity to the average velocity remained almost unchanged for low, medium, and high flows. In a few cross sections, a considerable amount of bed scour took place during high flows. A theoretical distribution was found to predict the lateral velocity distribution in the bends satisfactorily. The average value of the energy coefficient was 1.45 for straight reaches and 1.43 for bends. Similarly, the average value of momentum coefficients was 1.22 for straight reaches and 1.18 for bends. Average Manning's roughness coefficients varied from a minimum of 0.039 to a maximum of 0.053. During low flows, the Kaskaskia flows through a series of pools and riffles with larger diameter bed materials in the riffle and fine materials in the pool. The median diameter varied from 40 mm in the riffle to 0.04 mm in the pool. The Froude number varied from 0.7 in the riffle to 0.01 in the pool. Head loss was about 2.48 ft/mile in one pool-riffle sequence and about 4.44 ft/mile in another. During high flows, the pools and riffles are all submerged, and their effects on the overall flow condition are minimal or nonexistent. (Humphreys-ISWS)
W80-03713

SOIL AND WATER LOSSES FROM CORN-SOYBEAN ROTATIONS,
Science and Education Administration, Ames, IA.
For primary bibliographic entry see Field 2J.
W80-03725

A GENERALIZED APPROACH TO KINEMATIC FLOOD ROUTING,
McMaster Univ., Hamilton (Ontario). Dept. of Civil Engineering and Engineering Mechanics.
A. A. Smith.
Journal of Hydrology, Vol 45, No 1/2, p 71-89, January 1980. 5 Fig, 1 Tab, 13 Ref.

Descriptors: *Flood routing, *Flood waves, *Model studies, Mathematical models, Flow, Water levels, Streamflow, Storage, Reservoirs, Reservoir storage, Flood profiles, Computer models, Equations, Analytical techniques, Hydrology, Kinematic flood routing.

The development of the kinematic wave flow routing equation was presented briefly, and certain of the fundamental conditions necessary for its successful application were discussed. A general algorithm was proposed, and several methods of kinematic routing in common usage were shown to be special cases of the algorithm. The performance of the finite-difference scheme was examined with respect to stability and convergence; truncation error was shown to be independently sensitive to weighting factors in the space and time dimensions. From this an explicit relationship was developed between these weighting factors and the numerical attenuation of the wave. Confirmatory evidence from numerical experiments was presented. Comparison with the diffusion form of the equation showed how the diffusion coefficient may serve to relate the space and time weighting factors and the physical properties of the channel system. Application to nonprismatic or natural channels was discussed. Finally, implementation of the algorithm in computer routines for the routing of flood waves in natural channels was discussed, including a recent development in which the weighting factors are made time dependent. (Sims-ISWS)
W80-03732

ON THE MAGNITUDE OF INTERFACIAL SHEAR OF SUBCRITICAL STRATIFIED FLOWS IN RELATION WITH INTERFACIAL STABILITY,
Waterloopkundig Lab., Delft (Netherlands).
G. Abraham, M. Karelse, and A. G. van Os.
Journal of Hydraulic Research, Vol 17, No 4, p 273-287, 1979. 6 Fig, 2 Tab, 28 Ref.

Descriptors: *Stratified flow, *Subcritical flow, *Interfaces, *Model studies, Flow, Stability, Flow characteristics, Density currents, Boundary processes, Saline water-freshwater interfaces, Saline water intrusion, Mathematical models, Laboratory tests, Analytical techniques, Shear, Steady flow, Locks, Navigation, Water temperature, Two-layer flow, Salt wedge, Temperature surface wedge.

This paper elaborated upon the reasons why subcritical stratified flows may be treated as two-layer flows without mixing. The following stratified flow phenomena may be characterized as subcritical steady stratified flows: (1) arrested salt wedge, (2) temperature surface wedge, and (3) density-induced return currents. In internal mixing processes distinction must be made between the role of internal waves and turbulence. An important property of turbulence is its ability to transport quantities such as salt or heat across surfaces of constant density. There is little connection between the turbulent motion at well separated points in the fluid, and turbulent energy propagates slowly, with the speed of the fluid motion. Waves, on the other hand, may distort the density distribution to produce an apparent, transient layering, but they cannot permanently change the stratification unless they break to produce turbulence. They transfer energy more rapidly through the fluid, varying only gradually as they do so. The conditions at the interface between the two layers of a subcritical stratified flow were considered on the basis of linear instability theory. It was shown that in subcritical stratified flows there is a tendency towards the development of an intermediate layer. This intermediate layer was shown to have a stabilizing effect as it eliminates instability of internal waves. Apparently it also reduces turbulence, as follows from the fact that the considered subcritical stratified flows may be treated as two-layer flows without mixing. The interfacial shear coefficient is likely to vary with the stage of development of the intermediate layer. Further, a summary of experimental data on the interfacial shear was given. The different types of subcritical stratified flows were treated separately as the significance of turbulence generated at the interface in comparison with turbulence generated at the bottom, and vice versa, varies with the type of stratified flow. (Humphreys-ISWS)
W80-03738

HYDRAULICS OF RECTANGULAR VERTICAL DROP STRUCTURES,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
M. A. Gill.
Journal of Hydraulic Research, Vol 17, No 4, p 289-302, 1979. 8 Fig, 4 Tab, 9 Ref.

Descriptors: *Spillways, *Structures, *Hydraulic structures, *Irrigation canals, Canals, Canal design, Hydraulics, Flow, Velocity, Channel flow, Equations, Model studies, Reviews, *Vertical drop spillways, Free drop structures.

Previous works of Moore, White, and Rand on the characteristics of the free overfall drop structures were briefly reviewed. A simple theory initially proposed by White was modified by introducing less drastic assumptions than the ones on which White's theory is based. The resulting theory is in closer agreement with experiment and the empirical equations of Rand than is White's theory. Experimental results were also given on the brink depth as an appendix. (Lee-ISWS)
W80-03739

HYDRAULICS OF A LARGE CHANNEL PAVED WITH BOULDERS,
Ministry of Works and Development, Wellington (New Zealand). Power Div.
S. M. Thompson, and P. L. Campbell.
Journal of Hydraulic Research, Vol 17, No 4, p 341-354, 1979. 7 Fig, 4 Tab, 17 Ref.

Descriptors: *Open channels, *Channels, *Open channel flow, Boulders, Hydraulics, Channel morphology, Channel improvement, Friction, Flow, Equations, *Loose boulders, Darcy friction coefficient, Channel stability.

Experience was described of a 41 m wide by 308 m long, open channel on a 0.052 slope, constructed of loose boulders and through which flows up to 140 cu m/sec are passed. A new expression for the Darcy friction coefficient was proposed with a theory based on published laboratory data. This equation was shown to fit the large channel and other published field data. Some observations were made on both the geometry and the stability of the paving. (Lee-ISWS)
W80-03741

THE GEOMORPHOLOGIC STRUCTURE OF HYDROLOGIC RESPONSE,
Universidad Simon Bolivar, Caracas (Venezuela).
For primary bibliographic entry see Field 2A.
W80-03743

INDEX TO SOURCES OF HYDROLOGIC DATA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 7C.
W80-03744

STANDARDS, OPTIMALITY AND RESILIENCE IN WATER-RESOURCE MANAGEMENT,
Harvard Univ., Cambridge. Div. of Applied Sciences.
For primary bibliographic entry see Field 6A.
W80-03750

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-1. SOUTHWEST FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03754

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-2. SOUTHWEST FLORIDA SURFACE WATER QUALITY.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03755

A TECHNIQUE FOR ESTIMATING HEIGHTS REACHED BY THE 100-YEAR FLOOD ON UNREGULATED, NONTIDAL STREAMS IN NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
R. W. Coble.
Geological Survey Water-Resources Investigations 79-69 (open-file report), July 1979. 14 p, 9 Fig, 2 Ref.

Descriptors: *Analytical techniques, *Peak discharge, *Floods, *Streams, *North Carolina, Flood recurrence interval, Forecasting, Estimating, Streamflow, Gaging stations, Drainage area, Regression analysis, Flood profiles, Maps, Appalachian Mountain region, Coastal Plains, *Piedmont.

A method for estimating heights reached by floods having a recurrence interval of 100 years is defined for nontidal streams with unregulated flows in North Carolina. The flood heights are the vertical distance between stream stage at median discharge (50 percent duration) and the 100-year flood stage and are defined for streams draining areas between 1 and 10,000 square miles. A flood-height drainage-area relation was determined by regression analysis for each of the three physiographic areas of the State; mountains, Piedmont and Coastal Plain. An illustrated example of how the method can be used in conjuction with topographic maps to estimate flood heights and delineate inundated areas by interpolation is given. (Kosco-USGS)
W80-03764

LOW-FLOW CHARACTERISTICS OF STREAMS IN THE PECATONICA-SUGAR RIVER BASIN, WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
D. A. Stedfast.
Geological Survey open-file report 79-1274 (WRI), August 1979. 92 p, 6 Fig, 2 Plates, 3 Tab, 17 Ref.

Descriptors: *Low flow, *Flow characteristics, *Streamflow, *Low-flow frequency, *Wisconsin, Watersheds(Basins), Streamflow forecasting, Base flow, Analytical techniques, Regression analysis, Gaging stations, Evaluation, *Pecatonica-Sugar River basin(Wis).

Low-flow characteristics of streams in the Pecatonica-Sugar River basin in Wisconsin are presented in tables. Included are estimates of low-flow frequency and flow duration at 11 gaging stations; low-flow frequency characteristics at 25 low-flow partial-record stations and 63 miscellaneous sites; and a list of base-flow discharge measurements at 160 miscellaneous sites. Equations are provided to estimate low-flow characteristics at sites without discharge measurements and at sites where one base-flow discharge measurement is available. The equations were determined from multiple-regression analyses that related low-flow characteristics at gaging stations and low-flow partial-record stations to basin characteristics. The standard error of estimate is provided for each method of estimating the low-flow characteristics. Standard error provides the user with the expected degree of accuracy for each method. (Kosco-USGS)
W80-03765

A PARAMETRIC MODEL CALIBRATED WITH A PHYSICALLY BASED MODEL FOR RUNOFF PREDICTION FROM UNGAGED STREAMS,
Battelle Pacific Northwest Labs., Richland, WA.
F. W. Bond, D. L. Chery, Jr., and E. S. Simpson.
Water Resources Bulletin, Vol 15, No 6, p 1640-1652, December 1979. 6 Fig, 8 Ref.

Descriptors: *Runoff, *Surface runoff, *Model studies, *Mathematical models, Streamflow, Watersheds(Basins), Calibrations, Rainfall, Hydrographs, Forecasting, Hydrology, Ungaged streams, Runoff prediction, Surface flow modeling.

Recent developments in the numerical solution of the governing partial differential equations for overland and channel flow should make possible physically based models that predict runoff from

ungaged streams. However, these models, which represent the watershed by sets of intersecting planes, are complex and require much computer time. Parametric models exist that have the advantage of being relatively simple, and once calibrated are inexpensive to use and require limited data input. In this study, a procedure was developed for calibrating a parametric model against a physically based model, utilizing base areas of one acre and one square mile, with the expectation that base areas can be combined to model real watersheds. Simulation experiments with the physically based model showed that for the one-acre base area, the dominant parameter (cell storage ratio, K) related to the slope and friction of the planes, whereas for one-square-mile areas, the dominant parameters (K plus a lag factor, L) relate to channel properties. These parameters decreased exponentially as rainfall intensity increased. (Sims-ISWS)
W80-03839

2F. Groundwater

COMPARATIVE STUDY OF GROUNDWATER RECHARGE RATES IN PARTS OF INDO-GANGETIC AND SABARMATI ALLUVIAL PLAINS,
Physical Research Lab., Ahmedabad (India).
P. S. Datta, B. I. Desai, and S. K. Gupta.
Mausam, Vol 30, No 1, p 129-133, January 1979. 4 Fig, 2 Tab, 15 Ref.

Descriptors: *Groundwater, *Recharge, *Groundwater recharge, *Soil water movement, Rainfall, Irrigation, Soil water, Aquifers, Tracers, Tritium, Evapotranspiration, Runoff, Mathematical models, On-site investigations, *India.

Tritium-tracing data of soil moisture movement for groundwater recharge estimation from four river basins in India were examined. Of the two commonly used empirical formulae, namely, Amritsar and Chaturvedi formulae, the former gives consistently higher estimate of groundwater recharge in all four regions. The Chaturvedi formula gives reasonable estimates of groundwater recharge for sandy loam soils in parts of Indo-Gangetic plains, but gives significantly higher values of groundwater recharge for similar soils in Sabarmati basin. For each basin based on tritium tracing of soil moisture movement, empirical relations were developed to estimate regional groundwater recharge. Since the hydrometeorological factors vary significantly from basin to basin and within parts of a basin, it is desirable to investigate each region individually. (Sims-ISWS)
W80-03636

PAUL SPRING: AN INVESTIGATION OF RECHARGE IN THE ROSWELL (NM) ARTESIAN BASIN,
New Mexico Inst. of Mining and Technology, Socorro. Geophysical Research Center.
G. W. Gross, P. Davis, and K. R. Rehfeldt.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-150758, Price codes: A10 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University, Las Cruces; Report No 113, December 1979. 135 p, 26 Fig, 8 Tab, 25 Ref, 5 Append. OWRT A-055-NMEX(2), 14-34-0001-6032.

Descriptors: *Natural recharge, *Artesian aquifers, *Tritium, Groundwater movement, Dating, Recharge, Spring waters, New Mexico, Perched aquifer, *Spring flow, Deep flow, Paul Spring(NMex), Roswell(NMex).

Paul Spring is the principal or sole discharge point of a perched localized aquifer of well defined boundaries. It is located on the western flank of the Roswell artesian basin, and conditions at Paul Spring are considered typical for a major portion of the basin. The recharge at Paul Spring could therefore provide insight into the recharge mechnisms controlling the basin's groundwater supply. The geology of the area was mapped in detail. Springflow was measured over a span of 453 days. Precipitation records of many years were available from a NOAA weather station in the area. Tritium was measured in spring discharge and precipitation. Numerical and stochastic analysis and cross-correlation were performed on the data. The results suggest that a deep flow component plays an important role, hitherto underestimated, in the groundwater recharge to the basin. This deep component is transmitted by the Permian Yeso Formation and the Glorieta Sandstone Member of the San Andres Formation. At Paul Spring, this accounts for as much as 80% of the discharge. No clear results were obtained for the Paul Spring aquifer's response time to precipitation events. The indications are that it is of the order of several months. This can be explained by the peculiar geologic structure, specifically the screening effect of the Glorieta sandstone, in combination with solution and collapse features in the Yeso formation which channel the recharge water. A longer series of springflow measurements under better controlled conditions is needed to clarify this problem. (Herman-NMex)
W80-03642

GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 6A.
W80-03710

PREPARATION OF FRIABLE AQUIFEROUS SPECIMENS,
Humphreys (Howard) and Partners, Reading (England).
For primary bibliographic entry see Field 8E.
W80-03719

MIXING MODELS AND IONIC GEOTHERMOMETERS APPLIED TO WARM (UP TO 60C) SPRINGS: JORDAN RIFT VALLEY, ISRAEL,
Weizmann Inst. of Science, Rehovot (Israel).
For primary bibliographic entry see Field 2K.
W80-03728

HYDROLOGY OF SMALL OCEANIC ISLANDS--UTILITY OF AN ESTIMATE OF RECHARGE INFERRED FROM THE CHLORIDE CONCENTRATION OF THE FRESHWATER LENSES,
Washington State Univ., Pullman. Dept. of Geology.
H. L. Vacher, and J. F. Ayers.
Journal of Hydrology, Vol 45, No 1/2, p 21-37, January 1980. 8 Fig, 18 Ref, 1 Append.

Descriptors: *Recharge, *Groundwater recharge, *Islands, Natural recharge, Hydraulic conductivity, Evapotranspiration, Coasts, Aquifers, Tracers, Chlorides, On-site investigations, On-site data collections, Data processing, Mathematical models, Hydrogeology, *Bermuda.

In Bermuda, as in other coastal and oceanic-island environments, rainfall has a significant chloride concentration. As a result, there is a relatively straight-forward way of estimating groundwater recharge by considering the Cl(-) ion as a tracer which is concentrated by evapotranspiration. The Cl(-) concentration of rainfall in Bermuda is about 15 ppm. That of the freshest part of the largest Ghyben-Herzberg lens is about 60 ppm. Taking the 60 ppm value as an indicator of the Cl(-) concentration of recharge, the average recharge rate is estimated at 0.25 of the 147-cm/yr average rainfall, or about 37 cm/yr. This estimate is similar to two other estimates of recharge in Bermuda, each derived from hydrogeologic field data: (1) a 33-cm/yr estimate inferred from a 2000000-sq m area of diversion in which outflows (extractions) are 2870 cu m/day and the change in storage is estimated at 1100 cu m/day, from the rate of lowering of the water table; and (2) an estimate of 35 to 45 cm/yr resulting from combination of the ratio of recharge to hydraulic conductivity of the Paget Formation (0.000012), determined from the configuration of the Ghyben-Herzberg lenses, and the hydraulic conductivity of the Paget Formation (85-100 m/day), estimated from the behavior of the water table. The agreement between the three estimates of recharge indicated that the rather simple and inexpensive technique of calculating recharge from Cl(-) content of rainfall and fresh groundwater can be a useful addition to the arsenal of techniques by which recharge of small oceanic islands can be evaluated. (Sims-ISWS)
W80-03729

KINETICS OF CHEMICAL PROCESSES IN A CARBONATE AQUIFER: A CASE STUDY OF WATER-ROCK INTERACTION IN THE AQUIFER OF WESTERN AND CENTRAL GALILEE (ISRAEL),
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
For primary bibliographic entry see Field 2K.
W80-03730

OCEAN TIDE EFFECT STUDY ON A COASTAL CARBONATE AQUIFER (MIOCENE OF ALGARVE, PORTUGAL) ((ETUDE DE L'EFFET DE MAREE OCEANIQUE SUR UN AQUIFERE CARBONATE COTIER (MIOCENE DE L'ALGARVE--PORTUGAL)),
Montpellier-2 Univ. (France). Lab. d'Hydrogeologie.
M. Razack, C. Drogue, C. Romariz, and C. Almeida.
Journal of Hydrology, Vol 45, No 1/2, p 57-69, January 1980. 5 Fig, 3 Tab, 8 Ref.

Descriptors: *Groundwater, *Hydrogeology, *Aquifers, *Tidal effects, Coasts, Mathematical models, Analytical techniques, Carbonate rocks, Limestones, Foreign research, On-site investigations, Diffusivity, Porous media, Hydraulic conductivity, Confined water, Aquifer characteristics, *Portugal.

The study of groundwater-table variations due to ocean-tide effects in a coastal aquifer may yield, under certain conditions, its hydrodynamical characteristics. Such a study was attempted about a zone of the limestone aquifer of the Miocene of Algarve (Portugal). Two computation methods can be utilized, depending on the form of the free-water table evolution: (1) a Carson-Laplace transform, or (2) adjustment of a sinusoidal variation law to the fluctuations. Their application permitted characterization of the aquifer's general hydrodynamical behavior. The model gives the most satisfying reconstitutions of the observations, particularly points out a seepage situation which fits quite well to the known geological conditions of the aquifer. (Humphreys-ISWS)
W80-03731

INDEX TO SOURCES OF HYDROLOGIC DATA,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 7C.
W80-03744

GEOHYDROLOGIC MODEL OF THE FLORIDAN AQUIFER IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT,
Florida Univ., Gainesville. Dept. of Geology.
A. F. Randazzo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151475, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Center, University of Florida, Publication No 46, 1980. 79 p, 22 Fig, 11 Tab, 72 Ref. OWRT B-032-FLA(3), 14-34-0001-7148.

Descriptors: *Aquifer characteristics, *Groundwater movement, *Porosity, *Permeability, *Ground-water resources, *Aquifer management, Limestones, Petrography, Water management, Aquifers, Facies, Diagenesis, Florida, Southwest Florida.

Nineteen carbonate rock cores from the Southwest Florida Water Management District and adjacent counties were analyzed by megascopic, microscop-

ic, X-ray diffraction, and atomic adsorption spectrometry techniques for the determination of lithofacies paleontology, mineralogy, and geochemistry. These wells penetrate biozones representative of the 'Tampa', Suwannee, Ocala, Avon Park, and Lake City Formations. Numerous depositional cycles were recognized by cyclic occurrences of rock types and depositional environments. Two processes of dolomitization are suggested: homogeneous dolomitization resulting in single-stage development of microtextured aphanotopic, peloidal and mosaic fabrics; and heterogeneous dolomitization resulting in multi-stage development of porphyrotopic and some mosaic fabrics. The pattern of crystallization fabric distribution appears to be related to sedimentologically defined depositional cycles. The type of visible porosity can be related to the type of crystallization fabric. Greatest total porosity is found in cavernous zones associated with formational contacts. Geochemical evidence supports a mixing zone model of diagenetic dolomitization for the Floridan Aquifer. Variations in sea level and fluctuations of the phreatic zone could cause the dolomitizing solutions to contact large volumes of rock through time, resulting in thick sequences of dolomite. (Heaney)
W80-03751

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3B. SOUTHWEST FLORIDA GROUND WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03756

STRUCTURAL CONTROLS OF HOT-SPRING SYSTEMS IN SOUTHWESTERN MONTANA,
Montana State Univ., Bozeman; and Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 1A.
W80-03760

GROUND WATER IN THE SAN JUAN BASIN, NEW MEXICO AND COLORADO,
Geological Survey, Albuquerque, NM. Water Resources Div.
F. P. Lyford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-108020, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-73, May 1979. 22 p, 11 Fig, 27 Ref.

Descriptors: *Groundwater, *Hydrogeology, *Aquifer characteristics, *Geology, Water quality, Water resources, Groundwater movement, Transmissivity, Dissolved solids, New Mexico, Colorado, *San Juan Basin.

Principal aquifers in the San Juan Basin of New Mexico and Colorado are the Entrada Sandstone, Westwater Canyon Member of the Morrison Formation, Gallup Sandstone of the Mesaverde Group, several sandstones in the Mesaverde Group above the Gallup (Dalton Sandstone Member of the Crevasse Canyon Formation, Point Lookout Sandstone, Menefee Formation, Cliff House Sandstone), and sandstones of Tertiary age. Most ground water flows from topographically high outcrop areas toward the San Juan River and Rio Grande valley. Much of the water may move through confining layers to other aquifers or to the land surface rather than discharging directly to the streams. Transmissivities of the sandstones range from 50 to 300 square feet per day. Lowest dissolved-solids concentrations occur in or near outcrops of the sandstones and increase in the direction of groundwater flow. Concentrations range from less than 500 milligrams per liter to more than 30,000 milligrams per liter. (Kosco-USGS)
W80-03763

GROUND-WATER RESOURCES OF GRANT AND SIOUX COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
P. G. Randich.
North Dakota County Ground-Water Studies 24--Part III, and North Dakota Geological Survey Bulletin 67--Part III, 1979. 49 p, 19 Fig, 5 Plates, 3 Tab, 52 Ref.

Descriptors: *Groundwater resources, *North Dakota, *Aquifer characteristics, *Water yield, *Water quality, Chemical properties, Potential water supply, Hydrogeology, Water wells, Water level fluctuations, Data collections, Maps, Hydrographs, Water utilization, *Grant County(N Dak), *Sioux County(N Dak).

Ground water in Grant and Sioux Counties is obtainable from aquifers of Late Cretaceous, Tertiary, Pleistocene, and Holocene age. The major bedrock aquifers in the counties are the Fox Hills and Hell Creek aquifers of Late Cretaceous age and the Cannonball and Ludlow, undifferentiated, and Tongue River aquifers of Tertiary age. Potential yields to individual wells range from about 5 to 150 gallons per minute. The water generally is soft and high in dissolved solids. Aquifers of Pleistocene age--the Shields, Elm Creek, St. James, Beaver Creek, and Battle Creek aquifers--underlie about 48 square miles in Grand and Sioux Counties. Well yields of as much as 1,000 gallons per minute are obtainable in a few places along the central axes of these aquifers. The major dissolved constituents in water from these aquifers are calcium, magnesium, sodium, bicarbonate, and sulfate. Aquifers of Holocene age are located in the alluvial deposits in the Cannonball River, Heart River, and Cedar Creek valleys. Potential well yields generally are less than 50 gallons per minute. (Kosco-USGS)
W80-03767

DEVELOPMENT OF GROUND WATER IN THE HOUSTON DISTRICT, TEXAS, 1970-74,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 4B.
W80-03768

SELECTED HYDROLOGIC DATA FOR SPOKANE VALLEY, SPOKANE, WASHINGTON, 1977-78,
Geological Survey, Tacoma, WA. Water Resources Div.
E. L. Bolke, and J. V. Vaccaro.
Geological Survey open-file report 79-333, 1979. 98 p, 2 Fig, 1 Plate, 3 Tab, 6 Ref.

Descriptors: *Washington, *Hydrologic data, *Groundwater, *Basic data collections, *Water quality, Model studies, Computer models, Streamflow, Aquifers, Water wells, Springs, Water levels, Chemical analysis, *Spokane(Wash), Spokane Valley(Wash).

This report presents the ground-water data collected from March 1977 to May 1978 in the Spokane Valley, Spokane, Washington, for the purpose of developing a computer simulation of flow and mass transport in the Spokane aquifer. Data collected include an inventory of wells and springs, water-level data, and chemical analyses of water from selected wells and springs. (Kosco-USGS)
W80-03769

2G. Water In Soils

COMPARATIVE STUDY OF GROUNDWATER RECHARGE RATES IN PARTS OF INDO-GANGETIC AND SABARMATI ALLUVIAL PLAINS,
Physical Research Lab., Ahmedabad (India).
For primary bibliographic entry see Field 2F.
W80-03636

DETERMINATION OF SELECTED HYDRAULIC PROPERTIES OF SUBARCTIC SOILS,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. L. Kane.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-150956, Price codes: A03 in paper copy, A01 in microfiche. Completion Report 78-22, January 1980. 27 p, 8 Fig, 2 Tab, 25 Ref, 2 Append. OWRT A-064-ALAS(3).

Descriptors: *Soil water movement, *Subartic, *Alaska, *Cold regions, Snowmelt, Ablation, Permeability, Hydraulic conductivity, Porosity, Permafrost, Soil physical properties, Ice, Subsurface drainage, Runoff, Groundwater recharge.

The critical hydraulic properties of partially frozen soils were studied to aid in the evaluation of potential groundwater recharge and in forecasting surface runoff. Specific areas examined were (1) the redistribution of moisture in near-surface soils during winter, (2) infiltration rates for partially frozen soils, (3) the role of soil moisture content in runoff generation, (4) the hydrologic significance of surface organic soils, and (5) the importance of permafrost terrain in surface runoff generation. It was found that for snowmelt infiltration, the movement of soil water to the ground surface in winter drastically alters infiltration rates by forming an ice-rich zone at the surface. The higher the soil moisture content the greater the blockage at the surface. In many northern areas organic soil layers up to 50+ cm cover the permafrost terrain. The infiltration capacity of this organic layer is much higher than that of the underlying, sometimes frozen, mineral soils of the permafrost. If this organic layer is heavily saturated as it is during certain seasons of the year, incoming precipitation is rapidly translated into downslope flow and stream flow. Study results were presented at the Canadian Hydrology Symposium: 79-Cold Climate Hydrology and at the American Geophysical Union-Cold Regions Soil Water Problems. Copies of two papers presented at the symposiums are included. (See W80-03649 and W80-03650) (Seigler-IPA)
W80-03648

HYDROLOGIC ROLE OF SHALLOW ORGANIC SOILS IN COLD CLIMATES,
Pacific Northwest Forest and Range Experiment Station, College, AK. Inst. of Northern Forestry.
C. W. Slaughter, and D. L. Kane.
In: Determination of Selected Hydraulic Properties of Subarctic Soils, January 1980. Reprint of paper presented at Canadian Hydrology Symposium: 79 Cold Climate Hydrology, National Research Council of Canada, May 10-11, 1979, Vancouver, British Columbia. 10 p, 3 Fig, 1 Tab, 16 Ref. OWRT A-064-ALAS(1).

Descriptors: *Alaska, *Organic soils, *Permafrost, *Subarctic, *Runoff cold regions, Hydrographs, Watersheds(Basins), Permeability, Porosity, Saturated flow, Soil physical properties, Soil water movement, Subsurface drainage, Ice.

The effect on runoff of relatively shallow organic soils (20 to 50+ cm) that cover mineral soils in subarctic areas such as the Yukon-Tanana Uplands of Alaska is examined. When the organic layer is underlain by impermeable permafrost, a typical condition, rainfall or snowmelt causes the organic layer to become saturated. Water then moves rapidly downslope through the organic layer contributing significantly to surface runoff and creating a shallow water retention area. When the organic layer is not underlain by permafrost more infiltration into the lower mineral soil is possible resulting in less runoff. Factors affecting the role of organic soils in runoff include thermal, hydraulic, and physical properties such as bulk density, pore pressures, hydraulic conductivity, moisture content, and ice content. Seasonal conditions also result in changes. In winter organic soils that were moist at the time of 'freeze up' contribute moisture to the covering winter snowpack by vertical transport. Estimates are at 25 to 30% of the water equivalent of the snowpack. This desiccates the organic layer in winter and at least some of the spring snowmelt is utilized to satisfy this moisture deficit in the organic layer. In summer the organic layer acts as a shallow aquifer of downslope water movement into streamflow. To verify these conditions streamflow from two subdrainage systems of the Caribou-Poker Creeks Research Watershed were examined. Basin C-2 has about 3.5% permafrost by area while basin C-3 has about 53% permafrost. Results show that the permafrost dominated basin C-3 'flashier' in flow with high peak flows and low base flows

when compared to the C-2 basin. (See also W80-03648) (Seigler-IPA)
W80-03649

SNOWMELT INFILTRATION INTO SEASONALLY FROZEN SOILS,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. L. Kane.
In: Determination of Selected Hydraulic Properties of Subarctic Soils, January 1980. Reprint of paper presented at Cold Regions Soil Water Problems, American Geophysical Union, September 19-20, 1979, Calgary, Alberta. 9 p, 5 Fig, 1 Tab, 9 Ref. OWRT A-064-ALAS(2).

Descriptors: *Permafrost, *Infiltration, *Alaska, *Soil moisture, *Soil water, *Frozen soils, Ice, Porosity, Soil water movement, Snowmelt, Ablation, Loam, Silts, Gravimetric analysis, Permeability, Winter, Hydraulic conductivity, Pores.

The transmission properties of frozen unsaturated silt loam near Fairbanks, Alaska, were examined. The relationship of infiltration rate to soil moisture content was also studied. Because the techniques used were those accepted for determining the properties of unfrozen, unsaturated flow, exact results were not obtained but possible ranges of values for a given condition were. Infiltration rates were measured by filling an augerhole (11.1 cm in diameter and 20 cm in depth) with 0C water. This was done for both frozen and unfrozen soils. Moisture content measurements were made at several field sites by taking a soil core and using gravimetric analysis. Varying temperatures and organic contents were considered. Infiltration tests were conducted and infiltration curves were developed for the various conditions. Results show that the redistribution of soil water towards the ground surface in winter can drastically alter infiltration rates for frozen soils. As water moves to the surface in winter it forms an ice-rich zone near the ground surface by blocking soil pores. The higher the moisture content of soils, the more ice present in the frozen soil portion. This ice layer reduces infiltration from snowmelt and also reduces saturated hydraulic conductivity. (See also W80-03648) (Seigler-IPA)
W80-03650

A HYSTERESIS MODEL BASED ON AN EXPLICIT DOMAIN-DEPENDENCE FUNCTION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
Y. Mualem, and E. E. Miller.
Soil Science Society of America Journal, Vol 43, No 6, p 1067-1073, November-December 1979. 6 Fig, 11 Ref. NSF ENG 7800845.

Descriptors: *Hysteresis, *Mathematical models, *Pore water, *Pore pressure, Capillary water, Equations, Drying, Curves, Computer programs, Moisture content, Theoretical analysis, Laboratory tests, Domain water, Pore-water distribution function, Air-entry blockage.

A quantitative model of hysteresis is proposed, assuming the pore-water blockage against air entry to be a direct function of the volume of pore domains located in the completely filled region of the state diagram. The relative volume of the pore-water domains theta sub o, evaluated from the history of the capillary head psi assuming the domains are independent, is employed in a dependency correction function P* sub d (theta sub o). For calibration, this model requires only the main loop of hysteresis and one drying scanning curve. The merit of this 'Model III sub expl' compared with Model III is that any hysteretic process of wetting and drying is expressed analytically in explicit form. This property simplifies the computational procedure and saves computer time in practical application. The overall agreement between predicted and measured hysteretic behavior is acceptable. However, the study reveals that in the range of the air entry value the model does not reproduce the main drying curve accurately if it diverges considerably from the drying scanning curve. This deficiency may reflect the less physical ground for Model III sub expl compared to the implicit Model III. (Visocky-ISWS)
W80-03720

MEASURED AND APPROXIMATE FLUX-CONCENTRATION RELATIONS FOR ABSORPTION OF WATER BY SOIL,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Environmental Mechanics.
I. White.
Soil Science Society of America Journal, Vol 43, No 6, p 1074-1080, November-December 1979. 8 Fig, 9 Ref.

Descriptors: *Soil water, *Absorption, *Soil moisture, *Model studies, Mathematical models, Soil water movement, Steady flow, Infiltration, Soils, Irrigation, Soil properties, Soil science, Flux-concentration relations, Constant concentration, Constant flux.

The flux-concentration relation of Philip (1973) was calculated using moisture profiles measured during absorption of water by a fine sand when water was supplied at both constant hydraulic potential and constant rate. The general behavior of the measured flux-concentration relations was found to be consistent with those of the model soils calculated by Philip. Within the accuracy of the measurements, no significant time-dependence of the relation was found for the constant flux boundary condition over a large time span. Measurements of the time-averaged flux-concentration relation, however, suggest some significant time-dependence for short times. Simple approximations for the flux-concentration relation, based on these observations, were suggested. These approximations enable easily evaluated predictions to be made of the salient features of constant rate application of water to soil, which are sufficiently accurate for most practical purposes. (See also W74-02464) (Sims-ISWS)
W80-03721

INFILTRATION OF SOILS AS AFFECTED BY THE PRESSURE AND WATER CONTENT AT THE TIME OF COMPACTION,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
M. Akram, and W. D. Kemper.
Soil Science Society of America Journal, Vol 43, No 6, p 1080-1086, November-December 1979. 20 Fig, 1 Tab, 7 Ref. AID/ta-C-1411.

Descriptors: *Infiltration, *Soil compaction, *Compacted soils, *Laboratory tests, Pressure, Moisture content, Cohesive soils, Soil types, Soils, Soil water, Bulk density, Freezing, Thawing, Wetting, Drying, Soil science, Volume reduction, Soil piping.

Infiltration rates, volume reduction, and bulk densities of soils were determined on soils as a function of compacting pressures and water content at the time of compaction. Maximum compaction generally occurred when the soils were packed at water contents near field capacity. When compacting loads were less than 1 kg/sq cm, the minimum bulk densities occurred when soils had water contents of about one-half field capacity, indicating that surface tension of water films in the soils plays a major role in cohesiveness and stabilization against compaction under these conditions. Compacting loads of 3.46 kg/sq cm, at field capacity on sandy loams and finer textured soils, reduced infiltration rates to less than 0.1% of values obtained after these soils had been compacted when they were air dry. In a loamy sand soil this reduction was to about 1%. The low infiltration rates following compaction were increased by wetting and drying, although several cycles of wetting and drying did not raise the infiltration rate to the level observed before packing. Freezing and thawing cycles also increased the infiltration rates of previously compacted soils. Most of the change took place in the first freezing and thawing cycle. The large changes in infiltration rates using achievable levels of compaction at the 'optimum' water contents indicate that compaction can play a major role in the management of water in ditches, reservoirs, furrows, and watersheds. (Sims-ISWS)
W80-03722

RECLAMATION OF SALINE-SODIC SOILS BY LEACHING,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
W. A. Jury, W. M. Jarrell, and D. Devitt.
Soil Science Society of America Journal, Vol 43, No 6, p 1100-1106, November-December 1979. 8 Fig, 3 Tab, 16 Ref.

Descriptors: *Leaching, *Saline soils, *Alkaline soils, On-site investigations, Lysimeters, Cation exchange, Solutes, Land reclamation, Salts, Sodium, Chlorides, Magnesium, Irrigation, Soil chemistry, Soil chemical properties, Soil water, Soil types, Soil science.

Seven lysimeters containing sandy loam or clay loam soils were reclaimed by ponded or unsaturated leaching following a saline irrigation experiment of 2.5 years duration. Initial soil electrical conductivity was as high as 25 mmho/cm with associated exchangeable sodium percentages up to 60%. Substantial quantities of solid gypsum and lime were present in the soil profile from precipitation reactions during the crop irrigation stage. Drainage volumes were expressed in pore volume units to scale out differences between water retention and leaching rates. Plots of scaled chloride concentrations vs. pore volumes were similar for all lysimeters, with essentially all chloride removed by 1.5 pore volumes. Total salt removal was well described by a single curve for all treatments. Standard cation exchange equilibrium equations were used in a chromatographic displacement model to produce an algebraic equation to describe exchangeable Na reductions as a function of leaching pore volumes. This model, along with a model for calculating exchangeable Mg reductions, was in good agreement with measured changes for all treatments. No special amendments were required to maintain high permeability during leaching, even when distilled water was used, because of redissolution of previously precipitated Ca salts. (Sims-ISWS)
W80-03723

EFFECT OF TILLAGE ON SOIL-WATER MOVEMENT DURING CORN GROWTH,
Auburn Univ., Alabama. Dept. of Agronomy and Soils.
A. B. Weatherly, and J. H. Dane.
Soil Science Society of America Journal, Vol 43, No 6, p 1222-1225, November-December 1979. 2 Fig, 2 Tab, 19 Ref.

Descriptors: *Soil water movement, *Cultivation, *Crops, *Corn(Field), *Alabama, On-site investigations, Soils, Soil types, Soil properties, Hardpan, Soil water, Soil moisture, Droughts, Bulk density, Root zone, Crop response, Crop production, Agriculture, Farm management.

The occurrence of drought during the growing season often limits the amount of soil water available for plant growth. The availability of soil water can further be limited if a hard layer exists not too far below the soil surface. Field experiments were therefore conducted on a Cahaba sandy loam soil (Typic Hapludult) to determine the effect of tillage practices on soil water movement during corn growth. Four tillage practices, namely, conventional-tillage-without-subsoiling, conventional-tillage-with subsoiling, no-tillage-without-subsoiling, and no-tillage-with-subsoiling, were studied on a soil with a plow plan. Soil water contents and soil water pressure heads were measured with a neutron probe and tensiometers, respectively. Water extraction by roots was determined by application of the integral form of the general transport equation for soil water. Soil water movement and water uptake were less for the conventional-tillage-without-subsoiling treatment than for the other treatments. The two subsoiled treatments and the no-tillage-without-subsoiling treatment indicated root penetration and soil-water uptake below 50 cm. When soil water uptake patterns were compared with corn yield on a weight-per-ear basis, there was a direct, positive correlation between the amount of water taken up by the corn plants and corn yield. (Sims-ISWS)
W80-03724

INFLUENCE OF A COMPACT ZONE ON SOLUTE TRANSPORT DURING INFILTRATION OF WATER,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
G. S. Hira, and N. T. Singh.
Soil Science Society of America Journal, Vol 43, No 6, p 1251-1252, November-December 1979. 3 Fig, 7 Ref.

Descriptors: *Infiltration, *Compacted soils, *Solutes, *Soil water movement, Soil water, Soils, Chlorides, Salts, Ions, Root zone, Bulk density, Soil physical properties, Soil science, Agriculture, Compact zone, Compacted layers.

In most soils, continuous plowing results in the formation of a compact zone below the plowing depth. Laboratory studies were conducted to examine the effect of such a zone on the displacement of chloride (Cl-) during infiltration of water. A compact zone of 4- or 8-cm thickness of 1.62 g/cu cm or 1.80 g/cu cm bulk density was created at a depth of 8 cm in soil columns. A surface-applied slug of calcium chloride was leached with 4 or 6 cm of distilled water. The presence of a compact zone in the soil profile pushed the Cl- peak deeper, dispersed the ions in a narrower region, and increased the peak Cl- concentration. Increasing bulk density and thickness of a compact zone increased the depth of the peak Cl- concentration. (Sims-ISWS)
W80-03727

HYDRAULIC CONDUCTIVITY OF MOUNTAIN SOILS,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 2C.
W80-03775

2H. Lakes

FORMULATING LAKE MODELS WHICH PRESERVE SPECTRAL STATISTICS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
C. Babajimopoulos, and K. W. Bedford.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15137, p 1-19, January 1980. 5 Fig, 30 Ref, 2 Append. OWRT B-063-OHIO(4).

Descriptors: *Hydrodynamics, *Lakes, *Mathematical models, Model studies, Numerical analysis, Turbulence, Turbulent flow, Hydrology, Equations, Statistical methods, Analytical techniques, Velocity, Distribution patterns, Water circulation, *Pollution controls, Signal processing, Digital filter.

The ability of numerical lake models to predict verifiable results is very poor. Difficulties with the popular point-by-point verification method are intractable when confronted with these turbulent flows which have only reproducible statistics. A lake transport model was formulated which permits the calculation of not only mean field quantities but the known spectral details of turbulent flow. Higher order spatial averaging of the non-Linear terms by a low pass filter results in a sequence of third order differential terms. Additionally, the correlated terms resulting from the filtration are closed with the Smagorinsky subgrid scale viscosity representation. Finite difference representations were used with second order accurate schemes on the third order corrective differential terms and fourth order on all others. Mean flow field computations were verified by intercomparison with existing rigid lid circulation models. Differences between computations were negligible with only small increases in time and storage. (Lee-ISWS)
W80-03605

FISH MORTALITY AND FISHING DURING AN UNPRECEDENTED DRAUGHT IN LAKE PICHHOLA, UDAIPUR,
Udaipur Univ. (India). Dept. of Zoology.
V. S. Durve, and V. K. Rajbanshi.
India Journal of Fisheries, Vol 22, p 297-299, 1975. 2 Fig, 1 Ref.

Descriptors: *Fishkills, *Lakes, *Droughts, *Dissolved oxygen, Water shortage, Moisture deficit, Climatology, Dry seasons, Commercial fish, Lake morphology, Lake stages, Water temperature, *India.

A heavy mortality of fish occurred in Lake Pichhola in Udaipur, in May 1973, due to an unprecedented draught. While most of the smaller-sized fishes were dead, the larger ones were fished out and marketed before the lake totally dried up. The method of fishing adopted is briefly described. Oxygen content was reduced to 2.3 ppn and water temperature was 35.9C. Fish were surfacing for oxygen & mortalities insued. (Deal-EIS)
W80-03698

ON THE MAGNITUDE OF INTERFACIAL SHEAR OF SUBCRITICAL STRATIFIED FLOWS IN RELATION WITH INTERFACIAL STABILITY,
Waterloopkundig Lab., Delft (Netherlands).
For primary bibliographic entry see Field 2E.
W80-03738

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-1. SOUTHWEST FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03754

ANEROBIC METABOLISM OF IMMEDIATE METHANE PRECURSORS IN LAKE MENDOTA,
Wisconsin-Univ., Madison. Dept. of Bacteriology.
For primary bibliographic entry see Field 5C.
W80-03812

MICROBIAL METHANOGENESIS AND ACETATE METABOLISM IN A MEROMICTIC LAKE,
Wisconsin-Univ., Madison. Dept. of Bacteriology.
M. R. Winfrey, and J. G. Zeikus.
Applied and Environmental Microbiology, Vol 37, No 2, p 213-221, February, 1979. 5 Fig, 3 Tab, 27 Ref. NSF DEB 7824071 and DEB 73-01511-A01.

Descriptors: *Methane bacteria, *Metabolism, *Anaerobic conditions, *Microbial degradation, *Knaack Lake(WI), Water temperature, Anaerobic bacteria, Sediments, Microorganisms, Microbiology, Sediment-water interfaces, Carbon dioxide, Respiration, Depth, Meromixis, Nitrates, Sulfates, Water, Methane, Sulfides.

Methanogenesis in Knaack Lake, central Wisconsin, is highest in surface sediments (7.6 nmol CH4/10 ml h) at 22 m, considerably lower in deeper sediments (1.2 nmol CH4/10 ml h) and lowest in the water column (0.6 nmol CH4/10 ml h) at 21.5 m according to maximum rates calculated from 14-HCO3 reduction by endogenous electron donors. However, large dissolved methane concentrations (4,000 micro mol/l) occur in bottom waters and a maximum occurs 4 m above the sediment. Methane produced in the water column is of biological origin as no 14-CH4 is produced from 14C-labeled substrates in control experiments that contain formaldehyde. Temperature optimum for both methanogenesis from acetate and acetate respiration is 37C, characteristic of biological activity in nonthermophilic environments. Further experiments with 5 micro g sulfide/ml additions show methanogenesis stimulation from acetate, whereas the addition of higher concentrations inhibits methanogenesis. Acetate respiration is inhibited by 1.0 micro g sulfide/ml additions. Sulfate addition does not significantly inhibit methane production from acetate or increase acetate respiration from CO2. Nitrate addition, however, completely inhibits methanogenesis and slightly stimulates total 14-CO2 production. Knaack Lake is a small (1.1 ha) meromictic Lake with 22 m maximum depth. The lake is anaerobic below the thermocline (3 m) in the summer, mixes to 12-14 m during the fall, and is completely anaerobic under the ice in winter. (Danovich-Wisconsin)
W80-03813

A NINE-YEAR STUDY OF THE PHYTOPLANKTON OF THE EUTROPHIC AND NONSTRATIFYING LOCH LEVEN (KINROSS, SCOTLAND),
Institute of Terrestial Ecology, Edinburgh (Scotland). Plankton Ecology Project Group.
For primary bibliographic entry see Field 5C.
W80-03816

VERIFYING LAKE TRANSPORT MODELS WITH SPECIAL STATISTICS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
K. W. Bedford, and C. Babajimopoulos.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY1, Proceedings Paper 15138, p 21-38, January 1980. 10 Fig, 2 Tab, 35 Ref. OWRT B-063-OHIO(5).

Descriptors: *Dispersion, *Hydrodynamics, *Lakes, *Mathematical models, Model studies, Turbulence, Energy, Winds, On-site investigations, Numerical analysis, Calibrations, Circulation, Limnology, Spectra, Energy spectra, Variance analysis, Verifying.

A sequence of numerical experiments was performed to determine the suitability of coarse grid lake turbulence models developed in the paper in preserving theoretically known variance spectra. A complete review of theoretically known variance spectra was presented, and all relevant spectral data from aquatic field experiments were summarized. Three basins were used and set into motion by a spectrally correct Markov model wind shear. Wave number spectra were calculated by Taylor's hypothesis from time series collected at the basin center. Based on these numerical experiments, it was concluded that low pass filter preparation is a necessity for coarse grid spectra preservation. Traditional model formulations will not reproduce the known spectra. Experiments revealed that the hydrostatic pressure assumption and rigid lid pressure formulation only permit a two-dimensional turbulence structure which is, of course, not observed in field data except during fluid acceleration. (Sims-ISWS)
W80-03836

ATTENUATION OF LIGHT AND DAILY INTEGRAL RATES OF PHOTOSYNTHESIS ATTAINED BY PLANKTONIC ALGAE,
Minnesota Univ., Minneapolis. Dept. of Ecology and Behavioral Biology.
R. O. Megard, W. S. Combs, Jr., P. D. Smith, and A. S. Knoll.
Limnology and Oceanography, Vol 24, No 6, p 1038-1050, November 1979. 9 Fig, 3 Tab, 31 Ref. OWRT A-026-MINN(4).

Descriptors: *Photosynthesis, *Light, *Algae, *Plankton, Chlorophyll, Model studies, Mathematical models, Radiation, Irradiation, Equations, Theoretical analysis, Sampling, On-site investigations, Lakes, Organic matter, Attenuation, Limnology.

The daily integral rate of photosynthesis attained by planktonic algae in Lake Minnetonka, Minnesota, conforms to an equation for a rectangular hyperbola proposed by Bannister. The rate depends on the concentration of chlorophyll a in the mixed layer and also upon 2 kinetic parameters that are analogous to the kinetic constants in equations for reactions catalyzed by enzymes. One parameter is an upper limit, psi, that would be attained by very dense populations, and the other is a concentration of chlorophyll, c', at which attenuation of photosynthetically active radiation (PhAR) by the algae equals background attenuation by the water. The parameters were evaluated with the same statistical procedures used to evaluate the kinetic constants for enzyme reactions. The limit, psi, for the daily integral rate in this lake would be about 0.5 mol

02/m sq/d. Observed daily rates are usually less than 0.7 psi, because chlorophyll in the water usually intercepts less than 70% of the radiant energy. Coefficients for the attenuation of PhAR by chlorophyll, epsilon sub c, and by the water, epsilon sub w, were estimated from the linear regression of the total attenuation coefficient, epsilon, on chlorophyll concentration. The estimate of epsilon sub c is 0.022 + or - 0.005/m/mg Chl/m cu. Background attenuation, epsilon sub w, affects integral photosynthesis in the same way as a competitive inhibitor affects enzyme reactions: it is a constituent of c' = epsilon sub w/epsilon sub c which, together with chlorophyll concentration, determines the fraction of underwater PhAR intercepted by planktonic algae. (Sims-ISWS)
W80-03837

EARLY GROWTH OF PICEA SITCHENSIS (BONG.) CARR ON DEEP OLIGOTROPHIC PEAT IN NORTHERN IRELAND,
Ministry of Agriculture, Belfast (Northern Ireland).
For primary bibliographic entry see Field 2I.
W80-03863

COMPARATIVE BIOMASS AND GROWTH OF CYPRESS IN FLORIDA WETLANDS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2I.
W80-03866

AGE, ORIGIN, AND PALAEO-ECOLOGICAL EVIDENCE OF BLANKET BOGS IN NORDTRONDELAG, NORWAY,
Trondheim Univ. (Sweden). Dept. of Botany.
For primary bibliographic entry see Field 2J.
W80-03868

PHOTOSYNTHETICALLY ACTIVE RADIATION IN A STAND OF PHRAGMITES COMMUNIS TRIN. II. MODEL OF LIGHT EXTINCTION IN THE STAND,
Ceskoslovenska Akademie Ved, Trebon. Dept. of Hydrobotany.
J. P. Ondok.
Photosynthetica, Vol 7, No 1, p 50-57, 1973. 6 Fig, 2 Tab, 7 Ref.

Descriptors: *Marsh plants, *Energy conversion, *Model studies, Wetlands, Photosynthesis, Light intensity, Plant physiology, Primary productivity, Leaves, Structure.

A model of extinction of photosynthetically active radiation in a Phragmites stand is constructed on the basis of relative volume of shading (Vr) defined by the size of the plant aerial organs, their spatial distribution and by sun position. The suggested extinction law: R sub i = e to the (- sub i Vr) power (i = 1,2) is verified by experimental data and compared with other empirical formulae. Subscripts i specify the equation for extinction of both diffuse and direct radiation. (Steiner-Mass)
W80-03869

DIATOM FLORISTICS AND SUCCESSION IN A PEAT BOG NEAR LILY LAKE, SUMMIT COUNTY, UTAH,
Brigham Young Univ., Provo, UT. Dept. of Botany and Range Science.
S. A. Jatkar, S. R. Rushforth, and J. D. Brotherson.
Great Basin Naturalist, Vol 39, No 1, p 15-43, March, 1979. 8 Fig, 5 Tab, 43 Ref.

Descriptors: *Lake stages, *History, *Bogs, *Utah, Wetlands, Peat, Palynology, Succession, Lakes, Diatoms.

Diatoms from core samples obtained from the edge of Lily Lake, Summit County, Utah, were studied. Populations from each 15 cm of the core and niche metrics of the important species were analyzed. This study demonstrates four periods of history in the lake as mirrored by the diatom populations. The first period was mesotrophic and alkaline. This graded into an acidic, cystrophic period which in turn yielded again to a mesotrophic alkaline period. The most recent period can be characterized by a return to dystrophy. (Steiner-Mass)
W80-03872

PHYTOSOCIOLOGICAL STUDIES OF URYUNUMA MIRE STUDIES OF UPLAND BOG VEGETATION IN HOKKAIDO (II), (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Lab. of Plant Ecology and Taxonomy.
For primary bibliographic entry see Field 2I.
W80-03874

OPTIMAL NICHE SPACE OF THE RED-WINGED BLACKBIRD (AGELAIUS PHOENICEUS), I. NESTING SUCCESS IN MARSH AND UPLAND HABITAT,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-03875

EFFECT OF BENZOATE ON MICROBIAL DECOMPOSITION OF FULVIC ACIDS IN TJEUKEMEER (THE NETHERLANDS),
Institute of Limnology, Nieuwersluis (Netherlands).
For primary bibliographic entry see Field 2K.
W80-03893

2I. Water In Plants

HARPER SEEKS CLIMATE CONTROL WITH SPRINKLED VEGETABLES,
Arizona Farmer-Ranchman, p 12-15, August 1979. OWRT A-101-ARIZ(1), 14-34-0001-0103.

Descriptors: *Sprinkler irrigation, *Temperature control, *Soil temperature, *Vegetable crops, Irrigation efficiency, Arid climates, Arizona, Soil-water-plant relationships, Crop response, Evaporative cooling, Intermittent sprinkling, Water application.

Fred Harper and Dr. Arthur Pratt have been working on a 16-acre test with evaporative cooling via solid set sprinklers, west of Litchfield Park, Arizona, trying to get eight different vegetables to think they aren't being grown in Arizona summers where temperatures have been hitting 116 degrees. Harper and Pratt's work is designed to determine the effect of soil, filiage and fruit cooling through the use of sprinkler irrigation. They're also interested in determining whether water quality in terms of salt level has any adverse effect on plant growth and development when applied during high temperature periods. They want to know the effect of high humidity on pests and diseases; its effect on weeds; whether or not cooling growing conditions means better quality or eye appeal; and if cooling will allow growers to either extend their growing seasons further into the spring or plant earlier in the fall.
W80-03658

PHYTOMECHANICS--PLANT PHYSIOLOGY AND APPLIED MECHANICS,
Iowa State Univ., Ames.
D. B. Johnson, and C. P. Burger.
In: 'Developments in Theoretical and Applied Mechanics', Proceedings of 9th South Eastern Conference on Theoretical and Applied Mechanics, Vanderbilt Univ. Nashville, Tennessee, May 1978. Vol 9, p 553-562. OWRT B-062-IA (6), 14-34-0001-8086.

Descriptors: *Plant growth, *Plant physiology, *Growth rates, Soil-water-plant-relationships, Strain gage dendrograph, Dendromenter, Stress, Fatigue(Mechanics), Xylem, Water storage.

In plant physiology, the need for a simple, inexpensive, nondestructive method for continuously and accurately recording changes in stem diameters of woody plants has been recognized for nearly 100 years. A dendrograph which utilizes strain gages mounted directly on plant material appears to answer this need. Samples of data obtained with a strain gage dendrograph reveal that it is capable of recording complex dynamic changes in stem strain with an unprecedented degree of sensitivity.
W80-03780

CHEMICAL FLUCTUATIONS DUE TO SEASONAL AND CROPPING EFFECTS ON AN ALGAL-SEAGRASS COMMUNITY,
University of South Florida, Tampa. Dept. of Biology.
C. J. Dawes, K. Bird, M. Durako, R. Goddard, and W. Hoffman.
Aquatic Botany, Vol 6, No 1, p 79-86, January, 1979. 1 Fig, 3 Tab, 15 Ref.

Descriptors: *Benthic flora, *Tarpon Springs(FL), *Energy, *Plant growth, *Marine plants, Algae, Biomass, Energy conversion, Plant tissues, Plant physiology, Proteins, Marine algae, Primary productivity, Seasonal, Carbohydrates, Cutting management, Biochemistry, Growth rates.

Although total carbohydrate and protein levels vary between Thalassia and algal components in a seagrass bed off Tarpon Springs, Florida, 1977, final energy levels are roughly equal (4.2-4.3 kcal/g organic wt) for both components collected from plots before and after cropping or clearing. The seagrass bed is located 200 m offshore in one m of water at Sunset Park, Tarpon Springs on Florida's west coast. Highest protein levels occur in spring and range 3.2-10.6% for Thalassia (turtle grass) and 1.8-4.0% for algae. Protein levels are highest in regrowth collections from both totally cleared and cropped plots, suggesting protein synthesis during growth. Ash levels are 30-40% in turtle grass while algal ash levels are 60-70%. Ash levels are generally lower in turtle grass regrowth collections while algal regrowth has higher ash levels. No seasonal changes in ash content are evident for either component. Soluble carbohydrate levels are 3-12% for turtle grass and 6-10% for algae with highest levels in late spring and fall. Regrowth is very rapid in spring months and carbohydrate reserves can be replenished in four weeks. Results demonstrate that the algal component is energentically equal in importance to Thalassia. (Danovich-Wisconsin)
W80-03785

THE NUTRITIONAL ECOLOGY OF CYPERUS ESCULENTUS, AN EMERGENT AQUATIC PLANT, GROWN ON DIFFERENT SEDIMENTS,
Army Engineer Waterways Experimental Station, Vicksburg, MS. Environmental Lab.
J. W. Barko, and R. M. Smart.
Aquatic Botany, Vol 6, No 1, p 13-28, January, 1979. 5 Fig, 7 Tab, 33 Ref.

Descriptors: *Emergent plants, *Sediments, *Laboratory tests, *Nutrients, *Growth rates, Aquatic plants, Cultures, Nitrogen, Phosphorus, Limiting factors, Biomass, Organic matter, Nutrient requirements, Plant growth, Plant tissues, Soil chemistry, Sands, Bottom sediments, Rooted aquatic plants.

Nitrogen is growth-limiting for Cyperus esculentus, an emergent plant, grown in a greenhouse investigation with sediments obtained from Detroit River, Indiana Harbor, Michigan City Harbor, and Milwaukee Harbor. In sand cultures, Cyperus is similarly affected by selective removal of either nitrogen (N) or phosphorus (P). Shoot and tuber biomass directly correlate to both N and P supply. Critical concentration of N is 5.7 g/kg dwt and P is 0.95 g/kg dwt for Cyperus total biomass. Critical concentrations for shoots, tubers, and roots are 5.9, 5.2, 6.9 g/kg dwt, for N, respectively, and 0.79, 0.96, and 1.00 g/kg for P, respectively. Ratios of N:P are 7.5, 5.4, 6.9, and 6.0 for shoots, tubers, roots and total biomass, respectively. Sediments are predominatly fine textured but vary considerably in organic matter, P and N contents. Cyperus biomass ranges after three months growth on different sediments are substantial (0.6-18 kg/sq m). In general, shoot and tuber biomass are comparable at each site, and each exceeds root biomass. In

Cyperus both N and P are more concentrated in roots than in shoots and tubers. Tissue concentrations of N are less and P greater than the critical concentrations of these nutrients, suggesting that Cyperus growth is limited by N on most sediments used. Ratios of tissue N:P, when compated with sand culture values, substantiate N as the growth-limiting element. Ratios of belowground to aboveground biomass correlates negatively with plant growth. (Danovich-Wisconsin)
W80-03786

NITROGEN FIXATION BY THERMOPHILIC BLUE-GREEN ALGAE (CYANOBACTERIA): TEMPERATURE CHARACTERISTICS AND POTENTIAL USE IN BIOPHOTOLYSIS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 5F.
W80-03796

EXPERIMENTAL ECOLOGY WITH PARTICULAR REFERENCE TO PROPOSED COMMERCIAL HARVESTING OF DURVILLAEA (PHAEOPHYTA, DURVILLEALES) IN NEW ZEALAND,
Canterbury Univ., Christchurch (New Zealand). Dept. of Zoology.
C. H. Hay, and G. R. South.
Botanica Marina, Vol 22, No 7, p 431-436, October 1979. 5 Fig, 2 Tabb, 5 Ref.

Descriptors: *Plant growth, *Harvesting, *Colonization, *Phaeophyta, Ecology, Growth rates, Density, Littoral, Reproduction, Seasonal, Timing, Algae, Size, Weight, Methodology, Harvesting of algae, Biomass, Productivity, New Zealand, Durvillaea antarctica, Durvillaea willana.

Harvesting experiments on Durvillaea antarctica and D. willana, massive brown algae of lower littoral and upper sub-littoral rocky New Zealand coasts, respectively, show that year-round harvesting depletes standing stocks of both plants since harvesting time is critical in determining whether recolonization occurs the following season. Main study areas Tautuku and Kaikoura, localities 600 km apart on South Island east coast, were harvested 1972-1974. D. antarctica recolonization corresponds with the period of gamete release. Areas cleared April-June are recolonized by dense settlements: 7,000/sq m on Kaikoura and 1,400/sq m on Tautuku. Areas cleared after ganete release periods are poorly recolonized the following season (10/sq m) due to space competition with associated flora and invasion by other species. Although individual plant growth rates are highly variable, recolonizing D. antarctica stands are more uniform and compact than natural stands. Standing crops in experimental areas may be greater than in adjacent unmodified areas after 18 months. Harvesting methods are also important; removing holdfasts after harvesting causes dense recolonization and fast growth. Culling (removing only large fronds) increases small plant growth in the understory, but almost all those attached to composite holdfasts are later lost when holdfasts decay. Total reharvest of an area (Kaikours) culled 15 months previously is 32% of initial harvest. Whereas, 18 months regrowth on areas with removed holdfasts (Tautuku) weighs 1.5 times original wet weight. (Danovich-Wisconsin)
W80-03802

STREAM TYPES IN IDAHO: AN APPROACH TO CLASSIFICATION OF STREAMS IN NATURAL AREAS,
Idaho Univ., Moscow. Dept. of Biological Sciences.
For primary bibliographic entry see Field 6B.
W80-03835

A NUTRITIONAL ANALYSIS OF A SUBLITTORAL DIATOM ASSEMBLAGE EPIPHYTIC ON ENTEROMORPHA FROM A LONG ISLAND SALT MARSH,
City Univ. of New York. Dept. of Biology.
J. J. Lee, M. E. McEnery, E. M. Kennedy, and H. Rubin.
Journal of Phycology, Vol 11, p 14-49, 1975. 97 Fig, 8 Tab, 80 Ref.

Descriptors: *Nutrient requirements, *Epiphytology, *New York, *Salt marshes, Wetlands, Biological communities, Marshes, Marine microorganisms, Marsh plants, Marine bacteria, Diatoms.

The diatom population structure of a salt marsh epiphytic community growing on Enteromorpha intestinalis was studied. A total of 218 species or varieties were recognized. The distribution of many species in the community was seasonal. Changes in the population structure of the community were reflected by changes in the nutritional patterns as judged by differences in the growth of diatoms and bacteria on different media. Almost half of the colony types grew on either unenriched seawater or basal synthetic seawater. Nitrite inhibited algal growth. Soil extract or acetone extract of Enteromorpha tripled growth; a complex vitamin extract mixture, glycerol, mannitol, or an autoclaved extract of Enteromorpha doubled colony numbers. The greatest number of diatom types and total colonies were recovered on media enriched with acetone extract of Enteromorpha, suggesting a possible nutritional relationship between Enteromorpha and its epiphytes. The algal assemblage growing epiphytically on Enteromorpha has a diverse auxotrophic profile which contributes to the productivity and stability within this important component of the epiphytic community and that much of the organic substrates used by individual species originate within and are recycled among the community members. (Steiner-Mass)
W80-03862

EARLY GROWTH OF PICEA SITCHENSIS (BONG.) CARR ON DEEP OLIGOTROPHIC PEAT IN NORTHERN IRELAND,
Ministry of Agriculture, Belfast (Northern Ireland).
D. A. Dickson, and P. S. Savill.
Forestry, Vol 47, No 1, p 57-88, 1974. 9 Fig, 25 Tab, 18 Ref.

Descriptors: *Peat, *Plant growth, *Nitrogen, *Trees, Wetlands, Bogs, Minerals, Potassium, Phosphorus, Softwood, Deficient elements, Fertilizers, Herbicides, Forest management.

Relationships were examined between growth of young Sitka spruce, planted on deep oligotrophic blanket peat, and uptake of N, P, and K by the trees under various fertilizer and herbicide regimes. Despite the provision of adequate P, tree growth eventually becomes limited by a shortage of available N. This can be overcome at present only by repeated applications of fertilizer N. The use of herbicides to kill heather in checked crops increases the availability of N temporarily, and fertilizer K in all situations improves growth, though often only slightly. It is suggested that following the initial application of phosphate a finite fraction of the total N content of the peat becomes available to the trees. Once this has been used the release of mineral nitrogen is so slow that crops become N-deficient and growth is limited. (Steiner-Mass)
W80-03863

COMPARATIVE BIOMASS AND GROWTH OF CYPRESS IN FLORIDA WETLANDS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
W. J. Mitsch, and K. C. Ewel.
American Midland Naturalist, Vol 101, No 2, p 417-426, 1979. 2 Fig, 4 Tab, 21 Ref.

Descriptors: *Florida, *Swamps, *Plant growth, Wetlands, Biomass, Water pollution effects, Water levels, Environmental effects.

Lowest biomass and tree growth rates were found in cypress-pine associations indicative of low water, in monospecific stands of cypress that are indicative of high water levels, and in a poorly drained cypress dome. Increases in individual tree growth ranged from 1.0 to 3.5 kg/year in these groupings. Highest cypress tree growth rates were found in cypress-tupelo systems and cypress-hardwood systems. The latter are less dominated by cypress, however, so individual tree growth is greater. Cypress-hardwood associations are known to be generally better drained than cypress-tupelo systems. Two experimental cypress domes currently receiving treated sewage effluent and groundwater showed high individual tree growth (5.0 and 4.2 kg/year, respectively), but little difference was noted between the two domes. Tree diameter increase showed normal cypress tree growth to be 1.0-2.0 mm/year with higher values of 2.8-3.3 in cypress-hardwood associations and the experimental cypress dome. Cypress in the poorly-drained dome increased by only 2.0 mm/year. (Steiner-Mass)
W80-03866

A LOWLAND VEGETATION SEQUENCE IN SOUTH WESTLAND: PAKIHI BOG TO MIXED BEECH-PODOCARP FOREST. PART 1: THE PRINCIPAL STRATA,
Otago Univ., Dunedin (New Zealand). Dept. of Botany.
A. F. Mark, and P. M. F. Smith.
Proceedings of the New Zealand Ecological Society, Vol 22, p 76-92, 1975. 11 Fig, 2 Tab, 21 Ref.

Descriptors: *Bogs, *Forest, *Distribution patterns, Wetlands, Peat, Palynology, History, Vegetation, Biomass.

Six stands of lowland vegetation representing transitions from pakihi bog to mixed beech-podocarp forest are described quantitatively from the coastal plain of the Arawata and Jackson Rivers in South Westland. The sequence depicts progressive changes in canopy height, biomass and floristic richness, and appears to involve, at least in part, a primary succession. Some boundaries have been sharpened by periodic fires but the long-term trend remains unobscured. Pollen evidence indicates that the pakihi bog began as a lake when the surrounding area was forested by both podocarps and silver beech. The bog seems never to have supported a woody vegetation but in the absence of fire, forest would slowly encroach on it. With a highway traversing the sequence, its reservation for educational and scientific purposes has been proposed. (Steiner-Mass)
W80-03867

DISTRIBUTION OF MACROFAUNA ON A MALAYAN MANGROVE SHORE,
Malaya Univ., Kuala Lumpar (Malaysia). School of Biological Sciences.
A. Sasekumar.
Journal of Animal Ecology, Vol 43, No 1, p 51-69, February, 1974. 7 Fig, 5 Tab, 17 Ref.

Descriptors: *Mangrove swamps, *Distribution patterns, *Aquatic animals, Wetlands, Mollusks, Tidal effects, Swamps, Spatial distribution, Gastropods, Crabs, Environmental effects.

Environmental parameters and distribution of macrofauna in a Malayan mangrove shore were studied. The environment is characterized by plant cover, fine sediments with high water-contents, rich organic deposits and variable, often low salinity. Most of the mangrove shore is in the high tide range and is exposed to the air for over 90% of the time. The fauna consists predominantly of decapod crustaceans and gastropods with polychaetes in less variety but in significant numbers. The intertidal vertical range of a species is largely determined by tidal exposure time. Plankton feeders such as barnacles and oysters grow abundantly on the lower stems of trees (below high water of neap tides) on sea-facing edges where there is presumably a steady supply of plankton food. Other animals, including several species of polychaetes and grapsid crabs, occur in areas with over 90% exposure time. Considering the crabs, ten species of grapsids and five of ocypodids have successfully colonized the high shore, while ten species of ocypodids and three grapsids have remained at lower levels in streams and on the pioneer mangrove shore. Most gastropods occur in areas with over 90% exposure time. (Steiner-Mass)
W80-03870

THE ECOLOGY OF A SALTMARSH IN SRI LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Botany.
M. A. Pemadasa, S. Balasubramaniam, H. G. Wijewansa, and L. Amarasinghe.
Journal of Ecology, Vol 67, No 1, p 41-63, 1979. 10 Fig, 1 Tab, 31 Ref.

Descriptors: *Salt marshes, *Ecology, *Ecological distribution, Wetlands, Marshes, Marsh plants, Distribution patterns, Environmental effects, Zoning, Topography, Tidal effects.

The ecology of a saltmarsh system on a small islet on the north-west coast of Sri Lanka was investigated, using association-analysis and reciprocal averaging to order the floristic and edaphic data. Six chief plant communities--thorn scrub, dry saltmarsh pasture, an Arthrocnemum consociation, Suaeda communities, damp saltmarsh pasture and depressions--were tentatively recognized, and their ecological and floristic distinctiveness and interrelationships were further elucidated by the multivariate analyses. The distribution within the saltmarsh system of some selected edaphic factors such as moisture regime, water-retaining capacity, textural properties, organic-matter content, pH, and calcium, carbonate and chloride concentrations was established. The zonation of the saltmarsh vegetation is discussed in relation to the individual and integrated effects of several ecological factors, of which topography, textural variations of the soil, and exposure to floods, tides and winds, appear to be of particular importance. (Steiner-Mass)
W80-03871

DIATOM FLORISTICS AND SUCCESSION IN A PEAT BOG NEAR LILY LAKE, SUMMIT COUNTY, UTAH,
Brigham Young Univ., Provo, UT. Dept. of Botany and Range Science.
For primary bibliographic entry see Field 2H.
W80-03872

PHYTOSOCIOLOGICAL STUDIES OF URYU-NUMA MIRE STUDIES OF UPLAND BOG VEGETATION IN HOKKAIDO (II), (IN JAPANESE),
Hokkaido Univ., Sapporo (Japan). Lab. of Plant Ecology and Taxonomy.
K. Ito, and A. Umezawa.
Japanese Journal of Ecology, Vol 23, No 1, p 1-22, February, 1973. 2 Fig, 12 Tab, 25 Ref. (English summary).

Descriptors: *Bogs, *Marsh plants, *Japan, Wetlands, Fens, Distribution patterns, Systematics, Classification.

A marsh plant community classification was made of the Uryu-Numa mires, Japan. In the classification, sociations are first distinguished by the dominant or constant species, or by a combination of them, with the habitat indicators. The sociations distinguished are then grouped into associations by the characteristic species or sometimes by their combination with the plants which are usually conspicuous physiognomically. Five associations were recognized: (1) Hydrophytic community (5 sociations), (2) Hygrophytic community (4 sociations), (3) Fen vegetation (4 sociations), (4) Moss vegetation (12 sociations), and (5) Substitute community (2 sociations). (Steiner-Mass)
W80-03874

OPTIMAL NICHE SPACE OF THE RED-WINGED BLACKBIRD (AGELAIUS PHOENICEUS), I. NESTING SUCCESS IN MARSH AND UPLAND HABITAT,
Queen's Univ., Kingston (Ontario). Dept. of Biology.
R. J. Robertson.
Canadian Journal of Zoology, Vol 50, p 247-263, 1972. 3 Fig, 6 Tab, 50 Ref.

Descriptors: *Nesting, *Non-game birds, *Marshes, Wetlands, Wildlife, Wildlife habitat, Water birds, Nests, Vegetation effects, Water levels.

Survival value of different parts of the fundamental niche of the redwinged blackbird was determined by comparing nesting success in marsh and upland habitats. Marsh nesting populations had greater success than those in uplands because of a smaller proportion of nests destroyed by predators. Predation pressure in marshes was negatively correlated with the depth of water beneath the nest, and the synchrony and density of nesting in marshes in some cases has a swamping effect on local predator populations. The structure and phenology of marsh compared with upland vegetation is an important factor in determining nesting density and synchrony. Growth rates of nestlings and weight at fledging are similar between habitats. Genetic separation between marsh and upland populations is unlikely. Territoriality probably results in a limitation to breeding density in both habitats. The results support the hypothesis that where sympatric, redwings are excluded from their optimal niche space by yellow-headed blackbirds. (Steiner-Mass)
W80-03875

FACTORS AFFECTING TISSUE NUTRIENT CONCENTRATIONS IN A SCIRPUS-EQUISETUM WETLAND,
McGill Univ., Montreal (Quebec). Dept. of Biology.
N. D. Auclair.
Ecology, Vol 60, No 2, p 337-348, 1979. 5 Fig, 6 Tab, 39 Ref.

Descriptors: *Distribution patterns, *Nutrients, *Wetlands, Canada, Marsh plants, Succession, Rooted aquatic plants, Potassium, Plant physiology, Plant tissues.

Potassium and nitrogen (12.0-23.5 mg/g) had the highest tissue concentrations followed by Ca Na P Mg. Micronutrient concentrations (Fe Mn Zn Cu) ranged from 0.003-0.532 mg/g. Macronutrients were 1.3-6 times and micronutrients 2-20 times greater than reported in Carex, Fagus, and Quercus dominated ecosystems. All elements except Cu, Na, and Zn had closely similar patterns of interspecies variation. Chelation, ion antagonism, and increased solubility of micronutrients in flooded soils were possible mechanisms accounting for the unique patterns of Cu, Na, and Zn accumulation. Equisetum fluviatile had the highest level of total nutrients in green tissue. This was over twice that in Phragmite communis which had the lowest level. Element concentrations were 22.3% higher in pioneer species and 21.9% lower in mature species when compared to the community average. Edaphic parameters were 4 to 5 times more important than community structural attributes in varying tissue element concentrations. Among soil elements, potassium had the highest correlation with tissue P, K, Ca, and Mg concentration. Soil calcium had the highest correlation with tissue nitrogen and the micronutrients Cu, Fe, and Mn. (Steiner-Mass)
W80-03876

STRUCTURE OF MANGROVE FORESTS IN FLORIDA, PUERTO RICO, MEXICO, AND COSTA RICA,
Puerto Rico Dept. of Natural Resources, San Juan.
D. J. Pool, S. C. Snedaker, and A. E. Lugo.
Biotropica, Vol 9, No 3, p 195-212, 1977. 12 Fig, 5 Tab, 22 Ref.

Descriptors: *Plant morphology, *Mangrove swamps, Wetlands, Trees, Density, Height, Plant growth.

Structural parameters of mangrove forests were measured at seven geographical locations in Florida, Puerto Rico, Mexico, and Costa Rica. The largest basal area and most structurally developed mangrove forests were the riverine forests of the Atlantic coast of Costa Rica and the Marismas Nacionales, Mexico. The smallest basal area was measured for the dwarf mangroves in southeastern Florida and the fringe mangrove on the dry coast of Puerto Rico. Riverine and basin mangrove types had taller canopies than the scrub, fringe, and overwash types. Stand densities were greatest for the fringe forest at Jobos Bay, Puerto Rico and for the dwarf forest or scrub mangroves in Florida. No individual trees greater than 10 cm DBH were reported for either of these sites. Complexity indices ranged from 0.9 (Punta Gorda, Puerto Rico) to 97.5 (Jobos Bay, Puerto Rico). (Steiner-Mass)
W80-03879

COMPARISON OF THE ASSEMBLAGES OF SAP-FEEDING INSECTS (HOMOPTERA-HEMIPTERA) INHABITING TWO STRUCTURALLY DIFFERENT SALT MARSH GRASSES IN THE GENUS SPARTINA,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Entomology and Economic Zoology.
R. F. Denno.
Environmental Entomology, Vol 6, No 3, p 359-372, June, 1977. 12 Fig, 40 Ref.

Descriptors: *Biological communities, *Insects, *Marsh plants, *Salt marshes, Habitat, Wetlands, Marsh management, Marshes, New Jersey, Grasses, Distribution patterns, Spatial distribution.

The vegetation of New Jersey tidal salt marshes is composed primarily of 2 grasses; Spartina patens, which occupies a narrow elevational zone of high marsh and Spartina alterniflora, an intertidal species. S. patens forms a dense, persistent, thatch, while S. alterniflora produces only a loose lattice of litter which rapidly decomposes. A comparison between the guilds of sap-feeding insects (for the most part, Delphacidae, Cicadellidae, Issidae, and Miridae) inhabiting these grasses reveals S. patens housing a much more diverse assemblage of herbivores than S. alterniflora. S. alterniflora-inhabiting species are exclusively bi- or trivoltine, while on S. patens, sap-feeders possess a greater variety of life history types and show a specialized trend toward univoltinism. Removal of only the dead thatch portion of S. patens results in reduced species diversity and evenness of sap-feeders on the living grass system. Trivoltine species, which normally inhabit the upper strata of S. patens, increase their populations on dethatched grass compared to the unaltered grass system. Both empirical and experimental evidence suggests that the complex microstructure and thatch of S. patens provide a more heterogeneous and protective resource which supports a more diverse and specialized fauna of sap-feeders than S. alterniflora. (Steiner-Mass)
W80-03881

PATTERN AND DIVERSITY IN SWAMP AND DUNE VEGETATION, NORTH STRADBROKE ISLAND,
Queensland Univ., Brisbane (Australia). Dept. of Botany.
W. E. Westman.
Australian Journal of Botany, Vol 23, No 2, p 339-354, 1975. 3 Fig, 2 Tab, 23 Ref.

Descriptors: *Distribution patterns, *Marsh plants, *Dunes, Wetlands, Spatial distribution, Swamps, Grasslands, Competition.

The pattern of plant species distribution, species richness, the distribution of resources among species, and the manner of change of these parameters are examined in the closed-heath vegetation of a freshwater swamp, the grassland and low closed-forest of a frontal low dune sequence and the closed sclerophyllous forests of inland high dunes. The floristic diversity and complexity of spatial patterning within a small area is highest in the freshwater swamp vegetation. The complexity of the swamp vegetation is enhanced by a remarkable high species richness, a very low concentration of dominance and a high degree of intermingling of species. The swamp vegetation appears to have undergone a high degree of speciation; at the same time, intermixture of species and the small scale of patterning have served as a means of minimizing intraspecific competition. (Steiner-Mass)
W80-03882

2J. Erosion and Sedimentation

EROSION POTENTIAL ASSESSMENT FOR THE WILLAMETTE RIVER BASIN, OREGON,
California Inst. of Tech., Pasadena. Environmental

Quality Lab.
For primary bibliographic entry see Field 7C.
W80-03613

MEASUREMENTS OF COMBINED OSCILLATORY AND STEADY FLOW OVER A ROUGH BED,
MacDonald (Sir M.) and Partners, Cambridge (England).
For primary bibliographic entry see Field 8B.
W80-03620

A REEXAMINATION OF BAGNOLD'S GRANULAR-FLUID MODEL AND BED LOAD TRANSPORT EQUATION,
Scripps Institution of Oceanography, La Jolla, CA.
J. A. Bailard, and D. L. Inman.
Journal of Geophysical Research, Vol 84, No C12, p 7827-7833, December 20, 1979. 6 Fig, 13 Ref.

Descriptors: *Bed load, *Sediment transport, *Model studies, Mathematical models, Flow, Streamflow, Stress, Energy, Sediments, Sands, Rivers, Beds under water, Sedimentology, Bed load transport.

Bagnold's bed load transport model was reexamined by using only the momentum equation, the Coulomb yield criteria, and the definition of the rate of energy dissipation for a shearing fluid. The general form of Bagnold's bed load equation was rederived but with two specific differences: Coulomb's yield criteria, tan phi = T/P, holds only at the interface between regions of shearing and nonshearing grains, and the ratio of the mean to maximum granular velocity enters as an additional factor. (Sims-ISWS)
W80-03625

PARTICLE REWORKING IN SEDIMENTS FROM THE NEW YORK BIGHT APEX: EVIDENCE FROM 234TH/238U DISEQUILIBRIUM,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
J. K. Cochran, and R. C. Aller.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 739-747, December 1979. 5 Fig, 1 Tab, 21 Ref. NOAA 04-4-022-35.

Descriptors: *Sediments, *Cores, *Radioisotopes, *Benthic fauna, Sampling, Data collections, On-site investigations, Coasts, Sludge disposal, Sewage sludge, Water pollution, Uranium radioisotopes, Lead radioisotopes, Sedimentation, Sedimentation rates, Sedimentology, *New York Bight, Thorium radioisotopes.

Two diver-collected cores of mud-rich sediment from the New York Bight apex were analyzed for 238U and 232Th decay series nuclides with emphasis on 234Th/238U disequilibrium. Excess 234Th was present in both cores and showed exponential decrease in the top 4 cm. Biogenic reworking by a deposit-feeding community characterized by a Nucula proxima-Nephtys incisa assemblage apparently controls the form of the 234Th profiles. Mixing coefficients of 0.0000003-0.0000006 sq cm/s were calculated. No decrease of 210Pb with depth (0-11 cm) was found nor was there any vertical structure in profiles of 228Th. Episodic deposition followed by periods of stability cause the observed homogeneity of the longer lived nuclides as well as laminated horizons in the sediment. 234U/238U isotope ratios reflect addition of either seawater or sewage source uranium to the collection area. (Sims-ISWS)
W80-03629

SUSPENDED MATERIAL DISTRIBUTIONS IN THE WAKE OF ESTUARINE CHANNEL DREDGING OPERATIONS,
Connecticut Univ., Groton. Marine Sciences Inst.
W. F. Bohlen, D. F. Cundy, and J. M. Tramontano.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 699-711, December 1979. 8 Fig, 1 Tab, 11 Ref. ONR N00140-77-C-6536.

Descriptors: *Dredging, *Suspended solids, *Sediments, Rivers, Estuaries, Sediment transport, Particle size, Carbon, Turbidity, Water pollution, Storms, Streamflow, On-site investigations, Sampling, Temperature, Water temperature, Salinity, Coasts, Tidal waters, Connecticut, *Thames River(CT).

Field sampling of the suspended material field downstream of a large volume bucket dredge operating in the Lower Thames River estuary near New London, Connecticut, was conducted in order to examine the magnitude and character of the dredge-induced resuspension and to evaluate typical operational efficiency. These data indicated that approximately 1.5 to 3% of the sediment volume in each bucket-load is introduced into the water column producing suspended material concentrations adjacent to the dredge of 200 mg/l to 400 mg/l. These values exceeded background levels by two orders of magnitude. Analysis of particulate organic carbon and grain size characteristics indicated that resuspension also alters suspended load composition increasing the percentage of inorganic materials and median grain size. Proceeding downstream, material concentrations along the centerline of the dredge-induced plume decrease rapidly approaching background within approximately 700 m. Compositional variations display similar trends with the major perturbations confined to the area within 300 m of the dredge. The observed spatial distributions indicated that the dredge-induced resuspension is primarily a near field phenomenon producing relatively minor variations as compared to those caused by naturally occurring storm events. Previous work has shown that these latter systems can produce estuary-wide variations in suspended material concentrations, increasing the mass of material in suspension by at least a factor of two. This increase in total suspended load is nearly an order of magnitude larger than that produced by the dredge. (Sims-ISWS)
W80-03631

SURF ZONE DYNAMICS DURING UPWELLING ON THE OREGON COAST,
Williams Coll., Williamstown, MA. Dept. of Geology.
For primary bibliographic entry see Field 2L.
W80-03632

ROLE OF RILL DEVELOPMENT IN SALT LOADING FROM HILLSLOPES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
G. K. Sunday.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-152044, Price codes: A06 in paper copy, A01 in microfiche. MS Thesis, 1979. 107 p, 61 Fig, 13 Tab, 17 Ref, Append. OWRT B-170-COLO(1), 14-34-0001-8067.

Descriptors: Salinity, Water quality, Sediment, Channel behavior, Runoff conductivity, *Rill development simulation, *Sediment yield, Dissolved solids, Mancos shale, *Salt yield, Watershed, *Runoff, Slope, Colorado River Basin.

Field studies of salinity in runoff were conducted by applying runoff directly to the hillslope through a perforated pipe and, secondly, by rainfall simulation to produce runoff. Average electroconductivity (EC), a measure of total dissolved solids, was found to increase with increasing values of slope and after rilling of the hillslope. Rill development and flow velocities are further investigated since both are shown to be significant factors in high salt loads in runoff. Rill development is studied by computer simulation. The generated rill patterns are shown to be comparable to drainage systems measured in the field by Horton (1945). They also show characteristics similar to rill patterns generated in laboratory experiments by Mosley (1972). The results show that slope has a significant effect on the rill patterns as documented by geomorphologists (Zernitz, 1932; Howard, 1967). Keeping the sources fixed, the length of rills produced was shown to vary with slope and cross-slope and total rill length has been shown to be a factor in high sediment yields (Mosley, 1972). The computer simulation is shown to provide considerable promise for further studies of the relationships of geomorphic variables. A laboratory control situation was designed to isolate the effects of: (1) increased flow velocities; (2) different layers of Mancos shale (unweathered and weathered); and (3) particle size of shale. Linear relationships between electroconductivity and increasing flow velocities are provided. Further laboratory results indicated that for the same flow velocity, unweathered Mancos shale yields approximately twice as much salt to the flow as weathered Mancos shale if the two have a comparable size range (exposed surface area). Flow over large sizes of unweathered Mancos shale is shown to give slightly lower values of salinity compared to the weathered Mancos shale in the smaller size range.
W80-03643

SEDIMENTS SUSPENDED IN STREAM FLOW,
Akademiya Nauk SSSR, Moscow. Inst. Okeanologii.
S. M. Antsyferov, and R. D. Kos'yan.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15216, p 313-330, February 1980. 4 Fig, 1 Tab, 37 Ref, 2 Append.

Descriptors: *Sediments, *Suspended solids, *Diffusion, *Streamflow, Velocity, Suspension, Sediment transport, Model studies, Mathematical models, Laboratory tests, Equations, Mathematics, Sedimentology.

This paper considered a stationary translational sediment carrying flow. Correlation with experimental data enabled one to single out reliable solutions from a number of 'traditional' ones which were based on the concept of equality of moment transfer and sediment diffusion coefficients. By making use of energy considerations it became possible to delineate the area of applicability of the traditional diffusion model. An empirical expression was proposed to describe the distribution of concentration in the near-bottom region. The combination of the singled-out solution of the diffusion model with this empirical relationship allowed one to compile an expression describing the distribution of concentration over the entire depth of the flow, and to offer a suitable calculation procedure. (Sims-ISWS)
W80-03718

SOIL AND WATER LOSSES FROM CORN-SOYBEAN ROTATIONS,
Science and Education Administration, Ames, IA.
J. M. Laflen, and W. C. Moldenhauer.
Soil Science Society of America Journal, Vol 43, No 6, p 1213-1215, November-December 1979. 2 Fig, 2 Tab, 10 Ref.

Descriptors: *Soil erosion, *Crops, *Soybeans, *Corn(Field), On-site investigations, Runoff, Suspended solids, Dissolved solids, Sediments, Sediment yield, Rainfall, Water loss, Agriculture, Erosion control, Soil science.

Many people have observed what they felt was greater soil erosion by wind and water following production of soybeans. This experiment was conducted to measure the actual erosion following soybean production compared to that following corn production. Using natural rainfall plots at Beaconfield, Iowa, soil and water losses were measured from soybeans in a corn-soybean rotation and from corn in this same rotation and grown continuously over a 7-year period. Soil losses were found to be greater following soybeans than following corn in either a corn-soybean rotation or in continuous corn. This means more precautions must be taken to control erosion when soybeans are grown on sloping lands than when corn is grown. (Sims-ISWS)
W80-03725

RECENT GEOCHEMICAL HISTORY OF FLOOD DEPOSITS IN THE NORTHERN CHESAPEAKE BAY,
State Univ. of New York at Stony Brook. Marine

Sciences Research Center.
D. J. Hirschberg, and J. R. Schubel.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 771-784, December 1979. 8 Fig, 26 Ref, 1 Append. NSF OCE7809645.

Descriptors: *Floods, *Sedimentation rates, *Estuaries, *Chesapeake Bay, Radioisotopes, Radioactive dating, Sediments, Geochemistry, Sampling, Cores, Data processing, X-rays, X-ray analysis, Sedimentation, Sedimentology.

210Pb and 137Cs dating of sediment cores from the extreme northern Chesapeake Bay has revealed that episodic sedimentation events associated with Susquehanna River floods in 1936 and 1972 have contributed half of all sediment deposited in this area since 1900. Much of this sediment was derived from resuspension of sediment trapped along the riverbed during years of normal riverflow. The normal 210Pb determined sedimentation rate in this region, excluding flood events, was 0.45 cm/year which is in good agreement with rates previously estimated from sediment budget models. The long term sedimentation rate is probably twice this value which is in agreement with drainage basin sediment yield and denudation rate studies. (Sims-ISWS)
W80-03735

EROSIONAL ASPECTS OF MANAGING URBAN STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
W. Whipple, Jr., J. M. DiLouie, Jr., and T. S. Pytlar, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153422, Price codes: A05 in paper copy, A01 in microfiche. Completion report, January 1980, 76 p, 27 Fig. OWRT B-067-NJ(2), 14-34-0001-8100.

Descriptors: Engineering strucrtures, Channels, *Channel morphology, *Erosion control, Bank stability, *Erosion, Floods, *Stream stabilization, *Urban runoff, Urban drainage, *Urbanization, *Storm runoff, *Culverts, Channel erosion, Channel improvement, *Environmental effects.

The erosional aspects of streams in urbanizing areas were investigated by correlating land use information and physical data on a number of New Jersey streams and by modeling process based upon sediment transport therory. It was concluded (1) that processes of urbanization, by means of increasing rates of runoff, greatly increased bedload capacity and hence erosive capability of streams, (2) that urbanizing streams are vulnerable to channel degradation and increased bank erosion, (3) that in such cases culverts at road crossings which create a retarding effect upon flood flows have a beneficial effect, both in reducing flood peaks downstream and in reducing channel erosion potential, and (4) that in urbanizing areas, an integrated approach appears desirable, including desing of detention basins, design of culverts at road crossings, use of energy dissipating structures, and a program of land use control.
W80-03773

AN EMPIRICAL MODEL FOR PHYSICAL PARAMETERS OF RECENT SEDIMENTARY DEPOSITS OF LAKE EKOLN AND LAKE VANERN,
National Swedish Protection Board, Uppsala.
For primary bibliographic entry see Field 5A.
W80-03790

HOLOCENE SEDIMENTATION AT CAPE SABLE, SOUTH FLORIDA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
H. H. Roberts, T. Whelan, and W. G. Smith.
Sedimentary Geology, Vol 18, p 25-60, 1977. 21 Fig, 4 Tab, 22 Ref.

Descriptors: *Intertidal zone, *Sedimentation, *Florida, Wetlands, Mud flats, Sediments, Shores, Beaches, Mangrove swamps.

A regionally distinct mosaic of sedimentary environments including beaches and beach ridges which formed under relatively high-energy conditions through low-energy, tide-dominated environments to quiescent inland lakes and ponds, exists at Cape Sable, south Florida. Environments of deposition from the sandy capes inland are: shell beaches and beach ridges, black mangrove mudflats, ponded mudflats, exposed mudflats, Lake Ingraham, coastal levees and supratidal plain, and ephemeral ponds. With exception of the beaches and beach ridges, sediments of the other environments are dominantly calcareous muds and silts and represent a depositional history related to frequency of tidal inundation and storms. Cores through the supratidal plain reveal a basal carbonate-mud sequence much like subtidal elements of modern Florida Bay. This unit has a typical marine carbonate-mineral suite, numerous shallow-marine molluscs, and an abundance of Thalassia root burrows. An intermediate intertidal unit characterized by marine-brackish carbonate sediments with algal laminations is overlain by massive aragonitic supratidal silts and silty clays. The entire sequence is capped by a dark, highly organic zone representative of the coastal levee and intervening algal-flat sediments. (Steiner-Mass)
W80-03864

LANGEBAAN LAGOON; A MIXED CARBONATE-SILICICLASTIC TIDAL ENVIRONMENT IN A SEMI-ARID CLIMATE,
Cape Town Univ. (South Africa). Marine Geoscience Unit.
B. W. Flemming.
Sedimentary Geology, Vol 18, p 61-95, 1977. 22 Fig, 1 Tab, 36 Ref.

Descriptors: *Sediment distribution, *Lagoon, Wetlands, Tidal effects, Mudflats, Hydraulics, Salt marshes, Sedimentation, Sediments.

Langebaan lagoon divides physiographically into a north-south sequence following the modern energy gradient. In contrast, sediment distribution is east-west aligned, dividing the lagoon into two major provinces that reflect a different, relict energy regime. The sediments consist predominately of a quartz-carbonate mixture. Both sedimentary components are in hydraulic equilibrium although concentration levels are diametrically opposed. The carbonate content decreases over 40% in the north to less than 5% in the south. The differential concentration is explained by selective separation of the carbonate component during the transportation phase of the sediment. The modern sand banks and intertidal flats are underlain by large fossil oyster reefs dating between 6,000 and 2,000 years B.P. Primary sedimentary structures are environmentally sensitive. Large underwater dunes occur in the channels. The upper intertidal flats, close to the lagoonal beaches are characterized by a distinct association of primary structures. (Steiner-Mass)
W80-03865

AGE, ORIGIN, AND PALAEO-ECOLOGICAL EVIDENCE OF BLANKET BOGS IN NORDTRONDELAG, NORWAY,
Trondheim Univ. (Sweden). Dept. of Botany.
U. Hafsten, and T. Solem.
Boreas, Vol 5, p 119-141, 1976. 9 Fig, 1 Tab, 25 Ref, 2 Append.

Descriptors: *Bogs, *Stratigraphy, *History, Wetlands, Peat, Palynology, Geologic time, Soil profiles, Pollen, Fens, Succession, Palaeoclimatology.

Pollen diagrams, C14-datings, and peat stratigraphy are presented from three sides in the Forradal sub-oceanic area in Nord-Trondelag, a moorland complex of flat and sloping fens and blanket bogs. The vegetational and climatic history during the last 8500 years is described, together with a survey of present-day conditions. This origin of the blanket-bog areas is shown to agree generally in both time and mode of genesis, with similar bog types in Scotland and northern England. Dates are given for the expansion of both alder and spruce, the latter occurring more than 1000 years later than in southeastern Norway. The possible role of provenance formation and Roman Iron Age amelioration of the climate is discussed in this connection. The course of the alder pollen curve indicates a drier and probably colder type of climate about 3000-2400 B.C. (Steiner-Mass)
W80-03868

2K. Chemical Processes

BEHAVIOUR OF MANGANESE IN THE RHINE AND SCHELDT ESTUARIES, II. GEOCHEMICAL CYCLING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 2L.
W80-03630

GEOLOGY AND GEOCHEMISTRY OF ARSENIC, ESTER DOME AREA, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
D. B. Hawkins, R. B. Forbes, C. I. Hok, and D. Dinkel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153232, Price codes: A02 in paper copy, A01 in microfiche. Completion Report 77-5, January 1980. 7 p. OWRT B-037-ALAS(1), 14-34-0001-8056.

Descriptors: Public health, Water, Domestic water, Potable water, *Arsenic, Gold, *Subsurface waters, Surface water, Alaska, *Path of pollutants, *Geologic mapping, *Ester Dome area(Alaska).

Geologic mapping of the Ester Dome area more clearly defined the previously recognized mineralized region there. Analyses of well cuttings from domestic wells show that the rocks in which some of the wells are drilled are enriched in arsenic and serve as an immediate source of arsenic to the groundwater flowing into the well. The primary source of arsenic in the waters is this arsenic-bearing sulfide mineralization. Stream sediments near mineralized areas tend to be enriched in arsenic, suggesting this analysis of stream sediments might be useful for geochemical prospecting for sulfide minerals and the accompanying gold mineralization. Garden vegetables grown with arsenic-enriched water tend to become somewhat enriched in arsenic, but a much greater health hazard comes from drinking this water.
W80-03712

RECLAMATION OF SALINE-SODIC SOILS BY LEACHING,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
For primary bibliographic entry see Field 2G.
W80-03723

MIXING MODELS AND IONIC GEOTHERMOMETERS APPLIED TO WARM (UP TO 60C) SPRINGS: JORDAN RIFT VALLEY, ISRAEL,
Weizmann Inst. of Science, Rehovot (Israel).
E. Mazor, D. Levitte, A. H. Truesdell, J. Healy, and A. Nissenbaum.
Journal of Hydrology, Vol 45, No 1/2, p 1-19, January 1980. 12 Fig, 2 Tab, 14 Ref.

Descriptors: *Mixing, *Model studies, *Geothermal studies, *Thermal springs, *Geochemistry, Springs, Aquifers, Stable isotopes, Thermometers, Groundwater recharge, Gases, Meteoric water, Sampling, Silica, *Israel, *Geothermometers, *Noble gases, Ionic ratios.

Mixing models and evaluation of Si02 contents of warm-water manifestations in the Jordan-Dead Sea Rift Valley indicate that these waters are fed by aquifers with estimated temperatures of up to 68C. These calculations and Na/K ratios; concentrations of Na, K, and Ca; concentrations of atmospheric Ne, Ar, Kr, and Xe; and concentrations of the stable hydrogen and oxygen isotopes all indicate below-boiling temperatures. No indications are available for the existence of above-boiling geothermal systems in the Jordan Rift Valley. Slightly higher than observed temperatures are concluded for a deep component at the springs of

Hammat Gader (67C), Gofra (68C), the Russian Garden (40C), and the Yesha well (53-65C). These temperatures may encourage further developments for spas and bathing installations and, to a limited extent, for space heating, but are not favorable for geothermal power generation. (Visocky-ISWS)
W80-03728

KINETICS OF CHEMICAL PROCESSES IN A CARBONATE AQUIFER: A CASE STUDY OF WATER-ROCK INTERACTION IN THE AQUIFER OF WESTERN AND CENTRAL GALILEE (ISRAEL),
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Inst. of Soil and Water.
A. Nadler, M. Magaritz, F. Mazor, and U. Kafri.
Journal of Hydrology, Vol 45, No 1/2, p 39-56, January 1980. 5 Fig, 7 Tab, 27 Ref.

Descriptors: *Kinetics, *Carbonate rocks, *Aquifers, *Chemical reactions, *Water chemistry, Geochemistry, Geologic control, Groundwater movement, Dolomite, Chemical analysis, Sampling, Retention, Bicarbonates, Alkalinity, Saline water, *Water-rock interaction, *Chemical processes, *Israel, Ionic ratios.

The origin of ions in the groundwater of the western and central Galilee (W.C.G.) aquifer is attributed to the dissolution of carbonate rock. Similar chemical compositions have been obtained in laboratory experiments that simulated natural conditions. The field and experimental data indicate the time dependency of ionic composition. A linear correlation was found between the Mg(2+) concentration and the aquifer decay time. The kinetic factors of the W.C.G. groundwater were found to resemble other carbonate-aquifer waters, e.g., in Pennsylvania and Virginia. (Visocky-ISWS)
W80-03730

HYDROCHEMISTRY OF DISSOLVED INORGANIC CARBON IN THE ST. LAWRENCE ESTUARY (CANADA),
Quebec Univ., Rimouski. Dept. of Oceanography.
For primary bibliographic entry see Field 2L.
W80-03736

BEHAVIOR OF ABATE IN MICROORGANISMS ISOLATED FROM POLLUTED WATER,
Maryland Univ., College Park. Dept. of Entomology.
For primary bibliographic entry see Field 5F.
W80-03892

EFFECT OF BENZOATE ON MICROBIAL DECOMPOSITION OF FULVIC ACIDS IN TJEUKEMEER (THE NETHERLANDS),
Institute of Limnology, Nieuwersluis (Netherlands).
H. de Haan.
Limnology and Oceanography, Vol 22, No 1, p 38-44, January 1977. 5 Fig, 1 Tab, 20 Ref.

Descriptors: *Micerobial degradation, *Tjeukemeer(The Netherlands), Netherlands, *Acids, *Molecular structure, Microbiology, Microorganisms, Cultures, Size, Growth rates, Bacteria, Fluorescence, Metabolism, Arthrobacter, Sewage effluent, Humic acids, Ecology, Distribution, Absorption.

Microbial processes as well as hydrology may play a role in seasonal fluctuations in fulvic acid molecular size distribution in Tjeukemeer, The Netherlands. Results of media gel filtration containing fulvic acid clearly demonstrate that Arthrobacter microorganisms from Tjeukemeer affect molecular size distribution of fulvic acids. Moreover, the elution pattern before and after Arthrobacter growth on concentrated lake water to which benzoate had been added shows that fulvic acid fraction II is dependent on microbial activity. Benzoic acid additions affect both bacterial growth and color changes in incubated Tjeukemeer water; flourescence also significantly decreases. The observed effects indicate benzoate stimulation of fulvic acid microbial decomposition. Benzoate has a priming effect; it enhances the slowly proceeding decomposition process by actively metabolizing microbes. Although Arthrobacter cell yield on fulvic acid alone is 25 micro g/ml, benzoic acid additions to fulvic acid medium increases cell yield to 100 micro g/ml. The medium Sephadex elution pattern is affected by growing Arthrobacter cells. Before growth the medium contains fulvic acid fraction FI and benzoate. After growth benzoate disappears and a second fulvic acid fraction FII appears. Fraction FII, formed during Arthrobacter growth, is a FI derivative of relatively smaller size. (Danovich-Wisconsin)
W80-03893

2L. Estuaries

ON THE CALCULATION OF THE WIDTH AVERAGED FLOW DUE TO LONG WAVES IN AN OPEN CHANNEL,
Victoria Univ. of Manchester (England). Simon Engineering Labs.
For primary bibliographic entry see Field 2E.
W80-03619

SUBMARINE SLIDE-GENERATED WATER WAVES IN KITIMAT INLET, BRITISH COLUMBIA,
Institute of Ocean Sciences, Sidney (British Columbia).
T. S. Murty.
Journal of Geophysical Research, Vol 84, No C12, p 7777-7779, December 20, 1979. 2 Fig, 14 Ref.

Descriptors: *Landslides, *Inlets(Waterways), *Waves(Water), On-site investigations, Mathematical models, Coasts, Shores, Bays, Estuaries, Canada, *Submarine slides, *Kitimat Inlet(British Columbia).

A major submarine slide occurred on April 27, 1975, in Kitimat Inlet in the Douglas Channel system on the west coast of Canada. Following this slide at least two water waves were observed, and it was estimated that the range (crest plus trough) of the first wave could have been 8.2 m. Two simple theories were used here to estimate the wave height. By considering the uncertainties both in the observed data as well as in the calculated wave height, there was reasonable agreement. (Sims-ISWS)
W80-03627

SOME ASPECTS OF THE OCEANOGRAPHY OF THE GULF OF MEXICO USING SATELLITE AND IN SITU DATA,
Research Triangle Inst., Research Triangle Park, NC.
F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King.
Journal of Geophysical Research, Vol 84, No C12, p 7749-7768, December 20, 1979. 12 Fig, 5 Tab, 21 Ref. DOE EG-77-C-05-5444.

Descriptors: *Oceanography, *Gulf of Mexico, *Remote sensing, Satellites(Artificial), On-site investigations, Currents(Water), Ocean currents, Meanders, Circulation, Ocean circulation, Water circulation, Water temperature, Infrared radiation, Loop Current(Gulf of Mexico).

Satellite infrared data and in situ data were combined to study synoptic-scale and mesoscale fronts in the Gulf of Mexico in the period 1973-1977. Deep northward penetrations of the Loop Current were noted in the winter, and a major warm gyre developed in the winter, 1974. Other major warm gyres were seen to develop in the early spring (1974 and 1977). In all cases, a very large meander developed off the southern part of the west Florida shelf prior to the development of the major warm gyre. Smaller meanders were seen to move along the Loop Current boundary at an average speed of 28 km/day and with an average wavelength of 210 km. (Sims-ISWS)
W80-03628

PARTICLE REWORKING IN SEDIMENTS FROM THE NEW YORK BIGHT APEX: EVIDENCE FROM 234TH/238U DISEQUILIBRIUM,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W80-03629

BEHAVIOUR OF MANGANESE IN THE RHINE AND SCHELDT ESTUARIES, II. GEOCHEMICAL CYCLING,
Nederlands Inst. voor Onderzoek der Zee, Texel.
J. C. Duinker, R. Wollast, and G. Billen.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 727-738, December 1979. 9 Fig, 19 Ref.

Descriptors: *Manganese, *Estuaries, *Rivers, Sampling, On-site investigations, On-site data collections, Chemical analysis, Chemicals, Suspended solids, Dissolved solids, Salinity, Hydrogen ion concentration, Oxidation-reduction potential, Geochemistry, Sediments, Coasts, Oceans, Oceanography, Water chemistry, *North Sea coast, *Rhine Estuary, *Scheldt Estuary.

Measurements of dissolved and particulate suspended Mn concentrations throughout the Rhine and Scheldt estuaries were interpreted in terms of cycling processes of Mn. Dissolved Mn is removed in the lower estuary into particulate form. This gives rise to elevated Mn concentrations in coastal suspended matter; particulate Mn is also partially returned to the upper estuary by estuarine circulation processes. Dissolved Mn is produced in the upper estuary by dissolution of particulate Mn either in the water column owing to the low pH and Eh prevailing at low salinities or in the anoxic sediments, from where it subsequently diffuses into the overlying water. Budget calculations and other arguments showed that a significant part of the Mn carried down by the river is recycled between the lower and upper estuaries. An important part accumulates within the sediments; the fraction that escapes to the marine environment is mainly in particulate form. Very similar conclusions can be drawn for the two estuaries with quite different residence times of both water and particulates. (Sims-ISWS)
W80-03630

SUSPENDED MATERIAL DISTRIBUTIONS IN THE WAKE OF ESTUARINE CHANNEL DREDGING OPERATIONS,
Connecticut Univ., Groton. Marine Sciences Inst.
For primary bibliographic entry see Field 2J.
W80-03631

SURF ZONE DYNAMICS DURING UPWELLING ON THE OREGON COAST,
Williams Coll., Williamstown, MA. Dept. of Geology.
W. T. Fox, and R. A. Davis, Jr.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 683-697, December 1979. 9 Fig, 14 Ref. ONR N00014-69-C-0151.

Descriptors: *Coasts, *Beaches, *Upwelling, *Oregon, Beach erosion, Erosion, Deposition(Sediments), Sand bars, Winds, Weather, Tides, Atmospheric pressure, Waves(Water), Ocean waves, Currents(Water), Surf zone.

A 45-day time series study was conducted along the central Oregon coast during July and August 1973. The North Pacific Subtropical High dominated the weather pattern with strong north winds and coastal upwelling. Waves were 1-3 m high with periods of 6 to 9 s. The upwelling was interrupted when low pressure systems passed over the coast. With the low pressure, the wind shifted to the southwest, and the wave height increased. Rip currents and southward longshore currents in the surf zone reached 90 cm/s. The mixed diurnal-semidiurnal tide along the coast had a spring tide range of 4 m. Three beaches were mapped at low tide once every three days. At South Beach, Oregon, 2 sets of bars advanced shoreward at 1 to 5 m/day and expanded to the south at 5 to 15 m/day. A longshore trough and rip channel system which was active at mid-tide separated the bars. At Beverly Beach, a basalt ridge formed an island 400

m long and 730 m offshore. The island functioned as a detached breakwater and formed a protuberance on the beach. Sand bars and rip channels built up on the protuberance and migrated 200 m to the south. At Gleneden Beach, cusps with a wavelength of 40 m were formed on the steep foreshore. Rhythmic topography formed by bars and rip channels with a wavelength of 300 m developed on the nearshore. The bars advanced across the rip channel at 5 m/day and welded onto the foreshore. (Sims-ISWS)
W80-03632

THE ECOLOGY OF SANDY BEACHES IN PENANG, MALAYSIA, WITH SPECIAL REFERENCE TO EXCIROLANA ORIENTALIS (DANA),
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
D. A. Jones.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 677-682, December 1979. 3 Fig, 21 Ref.

Descriptors: *Beaches, *Biological communities, *Isopods, *Asia, Shores, Physical properties, Sampling, Waves(Water), Tropical regions, Biology, *Malaysia, *Penang(Malaysia), Surf zone.

The physical characteristics of a series of beaches of differing exposure on Penang Island, Malaysia, were measured, and the macrofauna were collected quantitatively. The zonation of the fauna on the upper and mid-shore agreed with that described for other tropical beaches, but the sudden transition to mud on the lower shore was exceptional. Excirolana orientalis has a wide distribution on the shore, and its relationship with similar isopods in other areas, where they occur together on the beach, was discussed. (Sims-ISWS)
W80-03633

THE SUBLITTORAL ECOLOGY OF THE MENAI STRAIT, I. TEMPORAL AND SPATIAL VARIATION IN THE FAUNA AND FLORA ALONG A TRANSECT,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
R. Hoare, and M. E. Peattie.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 663-675, December 1979. 4 Fig, 3 Tab, 20 Ref.

Descriptors: *Biological communities, *Currents(Water), *Tidal waters, Spatial distribution, Temporal distribution, Current meters, Measurement, Sampling, Turbidity, Scour, Erosion, Data processing, Ecology, Marine biology, *Menai Strait(Wales), Sublittoral organisms, Tidal currents.

The Menai Strait is a narrow channel subject to strong tidal currents but little wave action. The major physical factors which interact to control the nature and distribution of the fauna and flora are turbidity, scouring, current strength, and substratum. A simple device, based upon a spring balance, was used to measure maximum current strength near the bottom. The distribution of the fauna was studied by a transect survey across the Channel and compared with a similar survey in the same place 20 years earlier. The results suggested a high biological stability although some population fluctuations do take place. It was suggested that such general surveys be supplemented by more detailed investigations of individual species. (Sims-ISWS)
W80-03634

TIDAL HYDRAULICS IN ESTUARINE CHANNELS,
Snyder Oceanography Services, Inc., Jupiter, FL.
R. M. Snyder.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15202, p 237-245, February 1980. 3 Fig, 1 Tab, 8 Ref, 2 Append.

Descriptors: *Tidal waters, *Tides, *Channel flow, *Estuaries, Coasts, Harbors, Water circulation, Analog models, Canals, Open channels, Dredging, Flood control, Hydrodynamics, Hydraulics, Coastal engineering.

Alternating hydraulic flow (typical of estuarine areas) cannot be accurately treated using techniques developed for open channels or for the open oceans. As tidal energy approaches our coastlines, the potential energy is converted to kinetic energy resulting in forced vibrations within our estuarine systems. These 'hydraulical vibrations' are periodic rather than truly harmonic but can be considered to be harmonic for a first-order approximation. By making the analogy to electrical alternating current flow with a quadratic resistance term the equation of motion of tidal channel flow can be written. Solution of this harmonic equation in simplified form leads to expressions for channel resistance, channel capacitance, and channel inductance which combine, according to the phase angle between tidal amplitude and tidal current, to form channel impedance. These equations reduce to the familiar Darcy-Weisbach equation for steady-state open channel flow. (Sims-ISWS)
W80-03714

OCEAN TIDE EFFECT STUDY ON A COASTAL CARBONATE AQUIFER (MIOCENE OF ALGARVE, PORTUGAL) ((ETUDE DE L'EFFET DE MAREE OCEANIQUE SUR UN AQUIFERE CARBONATE COTIER (MIOCENE DE L'ALGARVE--PORTUGAL)),
Montpellier-2 Univ. (France). Lab. d'Hydrogeologie.
For primary bibliographic entry see Field 2F.
W80-03731

THE ISLAY FRONT: PHYSICAL STRUCTURE AND PHYTOPLANKTON DISTRIBUTION,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
J. H. Simpson, D. J. Edelsten, A. Edwards, N. C. G. Morris, and P. B. Tett.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 713-726, December 1979. 12 Fig, 9 Ref.

Descriptors: *Phytoplankton, *Physical properties, *Oceans, Coasts, Continental shelf, Salinity, Temperature, Water temperature, Currents(Water), Ocean currents, Density, Nutrients, Oceanography, *Fronts(Oceanic), *Scotland coast, *Irish coast.

A shelf sea front exhibiting strong salinity influence was described. Temperature plays only a secondary role in controlling the density although the frontal position conforms to the h/cu u model. Velocity measurements by current meters and radio drogues have defined the tidal flow and indicated residual currents of about 20 cm/s parallel to the front. These flows were time dependent with flow reversal occurring in the lower part of the water column. The observed velocity shear was of the same order as, but not in precise agreement with, the geostrophic shear inferred from the density gradient. In vivo and extracted chlorophyll measurements showed that phytoplankton standing crop at the front was several times greater, and was healthier, than that in the mixed water inshore. Chlorophyll was vertically stratified at the front and in the density-layered water offshore. High standing crop at the front may be explained in terms of nutrient availability to algae in the euphotic zone. The complex physical and biological processes influencing frontal productivity were discussed. (Sims-ISWS)
W80-03733

THE EFFECTS OF OYSTER SHELL DREDGING ON AN ESTUARINE BENTHIC COMMUNITY,
University of South Florida, Tampa. Dept. of Biology.
W. G. Conner, and J. L. Simon.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 749-758, December 1979. 5 Fig, 1 Tab, 18 Ref.

Descriptors: *Dredging, *Effects, *Biological communities, *Benthic fauna, *Florida, Coasts, Bays, Estuaries, Oysters, Shellfish, Sediments, Cores, Sampling, On-site investigations, Biomass, Biology, *Tampa Bay(FL), Dredging effects, Oyster shells, Species composition.

This paper described the extent and nature of the effects on the benthos of physical disruptions associated with dredging fossil oyster shell. Two dredged areas and one undisturbed control area in Tampa Bay, Florida, were quantitatively sampled before dredging and for one year after dredging. The immediate effects of dredging on the soft-bottom community were reductions in numbers of species (40% loss), densities of macroinfauna (65% loss), and total biomass of invertebrates (90% loss). During months 6-12 after dredging, the analysis used (Mann-Whitney U Test, alpha = 0.05) showed no difference between dredged and control areas in number of species, densities, or biomass (except the E sub 1 area). Community overlap (Czeckanowski's coefficient) between dredged and control areas was reduced directly after dredging, but after 6 months the pre-dredging level of similarity was regained. (Sims-ISWS)
W80-03734

RECENT GEOCHEMICAL HISTORY OF FLOOD DEPOSITS IN THE NORTHERN CHESAPEAKE BAY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 2J.
W80-03735

HYDROCHEMISTRY OF DISSOLVED INORGANIC CARBON IN THE ST. LAWRENCE ESTUARY (CANADA),
Quebec Univ., Rimouski. Dept. of Oceanography.
E. Pelletier, and J. Lebel.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 785-795, December 1979. 6 Fig, 2 Tab, 25 Ref.

Descriptors: *Water chemistry, *Estuaries, *St. Lawrence River, Chemicals, Alkalinity, Variability, Seasonal, Sampling, Chemical analysis, Temperature, Water temperature, Salinity, Carbon, Carbonates, Runoff, Discharge(Water), Hydrology, Dissolved inorganic carbon.

The concentration and the distribution of dissolved inorganic carbon were studied in the Upper St. Lawrence Estuary during three seasons in 1976. The data collected by the authors show that the dilution area directly influenced by the St. Lawrence River (mean annual discharge of 11300 cu m/s) is demarcated by the isohaline of 32.5 parts per thousand. The seasonal variations of the alkalinity of freshwater can attain 40%, but the quantity of bicarbonate ions brought by the river varies less than 8% from season to season. Budget calculations of dissolved CaC03 indicate that 45000000 tons per year is provided by the St. Lawrence River. This figure is almost 12 times more than all the suspended matter transported from the same source. (Sims-ISWS)
W80-03736

THE DESIGN AND USE OF AN OSCILLATING TROLLEY WAVE-SIMULATOR, FOR INSTALLATION IN UNIDIRECTIONAL FLOW FLUMES,
University Coll. of Swansea (Wales). Dept. of Geology and Oceanography.
T. M. Hammond, and M. B. Collins.
Estuarine and Coastal Marine Science, Vol 9, No 6, p 801-811, December 1979. 6 Fig, 19 Ref, 1 Append.

Descriptors: *Flumes, *Equipment, *Waves(Water), *Laboratory equipment, Sediment transport, Current meters, Flow, Shallow water, Hydraulic models, Oceanography, Wave generators.

The constructional details of an oscillating trolley arrangement, for installation in commercially available unidirectional flumes, was described. The apparatus was composed of commercially produced subassemblies and readily available materials. The oscillating trolley and flume were used to simulate combinations of oscillatory (representing near-bed oscillatory motion of waves in shallow water) and unidirectional flows in investigations concerned with the response of various current meter impellers and the threshold of (Woodhead) seabed drift-

ers and noncohesive sand-sized sediment; some of the results of these investigations, of particular relevance to coastal oceanographic investigations, were summarized. (Sims-ISWS)
W80-03737

ON THE MAGNITUDE OF INTERFACIAL SHEAR OF SUBCRITICAL STRATIFIED FLOWS IN RELATION WITH INTERFACIAL STABILITY,
Waterloopkundig Lab., Delft (Netherlands).
For primary bibliographic entry see Field 2E.
W80-03738

PHYTOPLANKTON DISTRIBUTION AND LIGHT ATTENUATION IN PORT HACKING ESTUARY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 5C.
W80-03799

SEASONAL OCCURRENCE AND VARIATION IN STANDING CROP OF A DRIFT ALGAL COMMUNITY IN THE INDIAN RIVER, FLORIDA,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
For primary bibliographic entry see Field 5C.
W80-03803

THE RELEASE OF REACTIVE PHOSPHATE BY A POSIDONIA AUSTRALIS SEAGRASS COMMUNITY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
For primary bibliographic entry see Field 2A.
W80-03808

CONSUMPTION OF EELGRASS, ZOSTERA MARINA, BY BIRDS AND INVERTEBRATES DURING THE GROWING SEASON IN LAKE GREVELINGEN (SW NETHERLANDS),
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
For primary bibliographic entry see Field 5C.
W80-03819

SPECIES COMPOSITION AND SEASONAL OCCURENCE OF CENTRIC DIATOMS IN A POLLUTED MARINE ENVIRONMENT,
Karachi Univ. (Pakistan). Inst. of Marine Biology.
For primary bibliographic entry see Field 5C.
W80-03820

WETLANDS OF THE SOUTH-WEST OF WESTERN AUSTRALIA WITH SPECIAL REFERENCE TO THE BUSSELTON AREA.
Australian Department of Fisheries and Wildlife, Perth, 1978, 18 p, 3 Fig, 2 Tab, 3 Ref.

Descriptors: *Wetlands, *Australia, Ecology, Wildlife habitat, Management, Wildlife, Marsh management, Estuaries, Swamps.

General information is given on the wetlands (swamps, rivers, estuaries) of the south-west of Western Australia, their value as wildlife conservation areas, their ecology, and some of the problems of their management. Particular attention is directed towards the wetlands of the Busselton area; namely, the Broadwater, Wonnerup and Vasse Estuaries. A brief account of their value to wildlife and their need for management is given. An outline of the future management trends of these areas is also provided. (Steiner-Mass)
W80-03861

A NUTRITIONAL ANALYSIS OF A SUBLITTORAL DIATOM ASSEMBLAGE EPIPHYTIC ON ENTEROMORPHA FROM A LONG ISLAND SALT MARSH,
City Univ. of New York. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-03862

HOLOCENE SEDIMENTATION AT CAPE SABLE, SOUTH FLORIDA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2J.
W80-03864

LANGEBAAN LAGOON: A MIXED CARBONATE-SILICICLASTIC TIDAL ENVIRONMENT IN A SEMI-ARID CLIMATE,
Cape Town Univ. (South Africa). Marine Geoscience Unit.
For primary bibliographic entry see Field 2J.
W80-03865

DISTRIBUTION OF MACROFAUNA ON A MALAYAN MANGROVE SHORE,
Malaya Univ., Kuala Lumpar (Malaysia). School of Biological Sciences.
For primary bibliographic entry see Field 2I.
W80-03870

THE ECOLOGY OF A SALTMARSH IN SRI LANKA,
Sri Lanka Univ., Peradeniya. Dept. of Botany.
For primary bibliographic entry see Field 2I.
W80-03871

INTERPRETATION OF UNENHANCED LANDSAT IMAGERY FOR WETLAND AND LAND USE DELINEATION IN THE TEXAS COASTAL ZONE,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 7C.
W80-03878

STRUCTURE OF MANGROVE FORESTS IN FLORIDA, PUERTO RICO, MEXICO, AND COSTA RICA,
Puerto Rico Dept. of Natural Resources, San Juan.
For primary bibliographic entry see Field 2I.
W80-03879

COMPARISON OF THE ASSEMBLAGES OF SAP-FEEDING INSECTS (HOMOPTERA-HEMIPTERA) INHABITING TWO STRUCTURALLY DIFFERENT SALT MARSH GRASSES IN THE GENUS SPARTINA,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Entomology and Economic Zoology.
For primary bibliographic entry see Field 2I.
W80-03881

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

LOW PRESSURE BRACKISH WATER REVERSE OSMOSIS MEMBRANE DEVELOPMENT - FINAL REPORT,
UOP, Inc., San Diego, CA. Fluid Systems Div.
C. E. Milstead, and R. L. Riley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153539, Price codes: A07 in paper copy, A01 in microfiche. Report to Office of Water Research and Technology, February 1980, 130 p, 40 Fig, 22 Tab. OWRT (No 7511) (1), 14-34-0001-7511.

Descriptors: *Membranes, *Reverse osmosis, *Brackish water, *Desalination, Spiral-wound elements, New Mexico, Arizona, *Roswell(N Mex), Yuma(Ariz), Composite membranes.

The principal objective of this three phase program was to develop a thin-film composite membrane system capable of yielding approximately 20 gal/ft to the 2nd power-day of product water from a brackish feed at 200 psi applied pressure with a rejection of 98%. Four types of composite membranes, prepared by interfacial polycondensation techniques on a fabric-reinforced porous polysulfone support, were evaluated. The optimum membrane, a polyamide, designated TFC-202, was successfully produced in large quantities for spiral-wound element fabrication. This membrane, yielding approx. 24 gal/ft to the 2nd power-day and approx. 98.5% rejection from a Yuma feedwater at 200 psi applied pressure, was fabricated into 2 1/2-,4-,and 8-in. diam. x 40-in. wide elements for field testing at the OWRT Test Facility at Roswell, N.M.
W80-03749

DESIGN OF AN INDIRECT FREEZING PROCESS PILOT PLANT BASED ON BULK CRYSTALLIZATION,
Johnson (Wallace E.) Co., Topsfield, MA.
W. E. Johnson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153596, Price codes: A04 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, December 1978. 36 p, 9 Fig, 3 Tab.

Descriptors: *Desalination, *Freezing, Indirect freezing, *Pilot plants, Design, Costs.

This report covers the rationale and design of a 2000 gpd pilot plant to demonstrate Indirect Freezing with bulk crystallization for desalination of water. During the 1950's indirect freezing processes utilizing film or block freezing were investigated and found to be uneconomical. This is a study of a process that employs the simplicity of indirect freezing without the cost of scraped surface heat exchangers on poor thermal efficiency of film or block freezing. An economic study made on the same basis as a recent OWRT commissioned report, showed a water cost of $1.74/1000 gallons at 5 MGD. Calculated energy consumption for a mature 1 MGD plant is 29.2 KW-HR/1000 gal. The pilot plant design is large enough to allow scaling to commercial size yet small enough to facilitate study of bulk crystallization. The estimated 1978 pilot plant cost is $225,000.
W80-03772

TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR DISTILLATION FOR LARGE SCALE PRODUCTION IN FRESH WATER.
Bechtel Corp., San Francisco, CA. Research and Engineering.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND77-8176, Price codes: A05 in paper copy, A01 in microfiche. Document prepared for Sandia Laboratories, Livermore, California, December 1977, 68 p, 20 Fig, 9 Tab, 3 Ref.

Descriptors: *Desalination plants, *Desalination processes, *Comparative costs, *Distillation, *Solar distillation, Treatment facilities, Desalination, Water treatment, Water purification, Desalination apparatus, Fuel costs, Economics, Equipment, Evaluation, Separation techniques, Solar stills, Solar energy, Economies of scale.

A review of existing technology and of expected rises in fuel-oil costs reveals that, while it is presently cheaper to distill potable water by means of an oil-fired distillation plant (assuming plant size of 5 million gallons/day), costs of distilling water from solar-driven and oil-fired plants will by equal within 15 years. The study concludes: (1) Water costs from a solar-driven vertical tube evaporation (VTE) distillation unit will become competitive with those from oil-fired distillation units within 15 years if annual fuel escalation costs remain in excess of 5%. (2) A comparative assessment of competing solar collector designs should be conducted to identify the economic choice of solar energy collection systems for a distillation plant. (3) Performance of distillers operating with solar power plant waste heat should be evaluated. (4) Water costs from solar stills in some developing countries may be competitive with solar-driven and oil-fired conventional distillers. An existing facility cost audit adjusted to the present time

frame is needed. Research efforts included a literature survey of single- and multi-effect solar stills and solar-driven conventional distillation units. A simplified conceptual design is given of a candidate plant and of a non-solar distillation plant, and an economic comparison is made of alternative designs. (Harris-Wisconsin)
W80-03842

3B. Water Yield Improvement

INTERIM PROGRESS REPORT SUPPLEMENT A – DATA ANALYSIS, SCPP DATA COLLECTION AND ANALYSIS FOR THE PERIOD 1 JANUARY 1979 THROUGH 30 JUNE 1979,
Atmospherics Inc., Fresno, CA.
M. E. Solak, R. B. Allan, and T. J. Henderson.
Prepared for the Office of Atmospheric Resources Management, Department of the Interior, Water and Power Resources, January 31, 1980. 107 p, 92 Fig, 1 Tab. 9-07-85-V0020.

Descriptors: *Mountains, *Hydrologic data, *Meteorological data, *Precipitation(Atmosphoric), Precipitation gages, Cloud seeding, Weather modification, Sierra Nevada, California, Ice, Snowfall, Rainfall intensity.

Precipitation measurements and ice nucleus counter data collected in the American River Basin in the Sierra Nevada during a six month period in 1978 and 1979 are analyzed. Data were collected from precipitation gages, surface meteorological stations, ice nucleus counters, high volume filter samples, and snow samplers. The data were prepared manually from manually-reduced records. Interpretation of precipitation measurements for the area are complicated by the mountainous terrain, however, the relationship between gage elevation and precipitation accumulation seen in the traverse profiles was considered during isohyetal map production. The manually-produced barrier traverse profiles reflect gage spacing along the traverse with precipitation amounts expressed in millimeters. A general seasonal pattern of increasing precipitation accumulations at increasing elevations is seen for the windward slopes of the barrier with decreasing amounts on the lee slopes, however, some cases differed substantially from this pattern. Precipitation rates analyzed represent the maximum houly accumulation. Ice nucleus measurements are plotted with concentrations expressed in numbers per liter at -20C. Data presented for priority 1, 2, and 3 cases and for significant precipitation periods include a brief description of the case, maps of gage locations, I-80 traverse precipitation profiles, and maps of ice nucleus counter sites with concentrations. (Seigler-IPA)
W80-03779

THE ANALYSIS OF RISK IN IRRIGATION PROJECTS IN DEVELOPING COUNTRIES,
University of East Anglia, Norwich (England). School of Developmental Studies.
For primary bibliographic entry see Field 6B.
W80-03851

3C. Use Of Water Of Impaired Quality

ENTEROVIRUS INACTIVATION IN SOIL AND STRUCTURAL CHANGES ASSOCIATED WITH THE INACTIVATION OF SOIL-BOUND VIRUSES,
New Mexico State Univ., Las Cruces. Dept. of Biology.
J. G. Yeager, and R. T. O'Brien.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149255, Price codes: A04 in paper copy, A01 in microfiche. New Mexico Water Resources Research Institute, New Mexico State University Report No 111, November 1979. 75 p, 12 Fig, 10 Tab, 62 Ref. OWRT A-052-NMEX(7), 14-34-0001-9033.

Descriptors: *Water reuse, *Sewage sludge, *Irrigation, *Soil bacteria, *Viruses, Soil types, Soil properties, Soil water movement, Evaporation, Soil moisture, Arid lands, Evaluation, Enterovirus, Coxsackievirus, Polio virus, *Virus inactivation.

The inactivation of polioviruses in soil was examined. It was shown that the inactivation of radioactively labeled poliovirus type-1 and coxsackievirus B-1 in soils saturated with surface water, groundwater and septic tank liquor was directly proportional to temperature. Virus persistence was also related to soil type and the liquid amendment in which viruses were suspended. No infectivity was recovered from dried soil regardless of temperature, soil type, or liquid amendment. Evaporation was largely responsible for the decreased recovery of infectivity from drying soil, however, increased rates of inactivation at low soil moisture levels may have amplified the virucidal effects of soil evaporation. The experimental results indicated that the loss of infectivity of poliovirus in moist and dried soils was a result of irreversible damage to the virus particles. Results suggest that polioviruses are inactivated by different mechanisms in moist and drying soils. Taken together, the findings suggest that any virus hazard associated with the application of wastewater or sewage sludge to agricultural land can be greatly reduced or eliminated by allowing the soil to dry after waste application. (Herman-NMex)
W80-03603

AN EVALUATION OF MARGINAL WATERS AS A NATURAL RESOURCE IN ISRAEL,
Technion-Israel Inst. of Tech., Haifa. Faculty of Agricultural Engineering.
N. Buras, and P. Darr.
Water Resources Research, Vol 15, No 6, p 1349-1353, December 1979. 1 Fig, 5 Tab, 5 Ref.

Descriptors: *Water reuse, *Brackish water, *Water resources, *Model studies, Mathematical models, Water demand, Water supply, Water sources, Evaluation, Costs, Cost analysis, Cost comparisons, Planning, Water importing, Arid lands, *Israel.

The scarcity of water in Israel and its possible effect on the socioeconomic development of the country have evinced considerable interest in the utilization of marginal waters. A nonlinear mathematical model was formulated, whose dual solution has shown that urban wastewater and brackish water have substantial values ranging up to 65% of the cost of imported freshwater. The nonlinear production function in the mathematical model permitted the detailed analysis of the impact of the economies of scale on the primal and dual solutions. The optimal allocation of water for the Central Negev in 1992 calls for 40% of the forecast total water demand to be supplied by 26 million cu m of treated urban wastewater and brackish water. (Sims-ISWS)
W80-03742

THE POTENTIAL FOR MUNICIPAL WASTEWATER REUSE BY INDUSTRY IN MASSACHUSETTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
J. Pratte, and W. Litsky.
In: Proceedings Water Reuse Symposium, March 25-30, 1979, Washington, D.C., Vol 2, p 1235-1246, 1979. 1 Fig, 5 Tab, 5 Ref. OWRT A-114-MASS (2).

Descriptors: *Water reuse, *Waste water, *Water conservation, *Industrial water, Attitudes, Massachusetts.

This investigation sought to determine the suitability of wastewater reuse by industry as a water conservation measure in terms of social, economic, institutional and technological feasibility. Personal interviews, guided by a questionnaire, were held with industrial and public sector individuals. The results indicated that industry is more accepting of wastewater reuse than water resource officials if a project is cost-effective. Although there are few suitable industrial recipients of reclaimed water in Massachusetts, the concept is worthy of more attention as water costs increase, sewage treatment plants are upgraded and alternative water supplies are sought. (See also W80-02760) (Godfrey-Mass)
W80-03747

ALGAE GROWN ON WASTEWATER AS A SOURCE OF PROTEIN FOR YOUNG CHICKENS AND RATS,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
S. Mokady, S. Yannai, P. Einav, and Z. Berk.
Nutrition Reports International, Vol 19, No 3, p 383-390, March 1979. 1 Fig, 4 Tab, 11 Ref.

Descriptors: *Wastewater treatment, *Beneficial use, *Feeds, *Aquatic algae, *Poultry, *Rodents, *Proteins, Micractinium, Chlorella, Oocystis, Scenedesmus, Chlorophyta, Foods, Sewage lagoons, Oxidation lagoons, Flocculation, Amino acids, Soybeans, Carp.

A study was made to estimate protein nutritive value of several algae species grown on wastewater, as a protein source in diets of young chickens. Rat feeding tests were also carried out, to determine the protein nutritive value of the different algae species and using PER values as a parameter. Results of the rat studies show that most algal samples have a fairly high protein nutritive value, as judged by PER values, even when algae was the only dietary protein source. However, best growth performance for chickens was obtained when algal protein was substituted only for 25% of soybean protein. Algae samples were incorporated into the rations of the experimental chickens as a partial replacement (25-50%) for soybean protein. In studying rat diets, dietary protein was derived from algae alone, from algae and soybean meal in equal parts and from algae supplemented by methionine and lysine; the latter substances are limiting amino acids in algal proteins. Algal samples used in feeding experiments were grown on sewage and drum-dried after harvest. Oocystis, Scenedesmus and Micractinium containing 38.5%, 48.7% and 51% protein, respectively, were harvested by flocculation with alum. Chlorella-euglena consisting mainly of Chlorella sp, containing 54% protein, was harvested by centrifugation. This study is presented as part of a two-paper series; other research discusses secondary toxicology and contaminants which algae pick up from wastewater and the degree to which these toxins are passed on to rats fed chicken and carp fish raised on wastewater algae. (Harris-Wisconsin)
W80-03817

SECONDARY TOXICOLOGY AND CONTAMINANTS OF ALGAE GROWN ON WASTEWATER,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
S. Yannai, S. Mokady, K. Sachs, B. Kantorowitz, and Z. Berk.
Nutrition Reports International, Vol 19, No 3, p 391-400, March 1979. 4 Tab, 20 Ref.

Descriptors: *Waste water treatment, *Toxicity, *Feeds, *Aquatic algae, *Human pathology, *Poultry, *Carp, Micractinium, Chlorella, Beneficial use, Chlorophyta, Oxidation lagoons, Sewage lagoons, Phosphates, Foods, Phosphorus, Mercury, Copper, Lead, Arsenic, Food chains, Rodents.

A study was conducted to evaluate the wholesomeness of animals (broiler chicken and carp fish) raised on rations containing a large quantity of algae of different species grown on wastewater. Results of secondary toxicity tests indicate that rats raised on diets containing chicken or fish which had been fed wastewater-grown algae did not differ significantly from rats fed chicken and fish which had received control rations. The amount of toxic metals in the unicellular algae (Chlorella and Micractinium) was high, but the only animal tissues affected were chickens' livers. Organochlorine pesticide levels in algae were low in all cases, but considerable PCB levels were found in all plants. There were large amounts of mercury, copper, lead and arsenic in muscle tissues of experimental chicken and mercury in experimental carp liver; these high concentrations did not bring about

corresponding high levels in animal tissues because unusually large amounts of phosphorus (especially as phosphate) occurred in all algae samples assayed. All four of the metals form water-soluble salts with phosphate; it is possible that these metals are thus rendered unabsorbable from the gastrointestinal tract. (Harris-Wisconsin)
W80-03818

3D. Conservation In Domestic and Municipal Use

RESIDENTIAL WATER REUSE,
California Univ., Los Angeles. School of Architecture and Urban Planning.
M. Milne.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-155377, Price codes: A23 in paper copy, A01 in microfiche. Technical Completion Report, California Water Resources Center, Davis Report No 46, September 1979. 553 p, 12 Fig, 4 Append. (California Water Resources Center Project UCAL-WRC-W-537).

Descriptors: *Water reuse, *Impaired water use, *Recirculated water, *Reclaimed water, *Water supply, *Architecture, Buildings, Construction, Construction materials, Structural design, Design, Planning, *Domestic wastes, *Domestic use, Beneficial use, *Water conservation, *Public health, *Water law.

Greywater, rainwater, groundwater, and surface water are sources of 'free' water already available to every homeowner on-site. This book explains the various ways to collect, store, treat, and distribute this water, and gives examples of how it has been successfully reused for toilet flushing, landscape irrigation, washing, bathing, or drinking. For many of these functions water can be reused directly without treatment. The argument in favor of water reuse is given along with a brief history of residential water reuse, how rainwater and groundwater can be developed as an on-site supply, the uses of greywater for garden irrigation, various residential-scale systems that have been designed for on-site reuse, and an explanation of the components needed to build such systems. The appendix contains a directory of manufacturers, a glossary of specialized terms, units of measure, and an annotated bibliography containing over 500 citations. The conclusion of this study is that residential on-site water reuse systems are already technically feasible and environmentally sound, and are becoming more economically attractive every day, due primarily to the rapidly increasing cost of energy required for pumping and treatment by centralized water and sewage systems. The objective of this book is to help homeowners, builders, developers, architects, planners, and lawmakers understand the design and installation of small on-site residential water reuse systems. (Snyder-California)
W80-03640

3F. Conservation In Agriculture

FLOW CONTROL DEVICES PARTICULARLY USEFUL FOR DRIP IRRIGATION,
M. Drori.
U.S. Patent No 4,173,309, 7 p, 25 Fig, 3 Ref; Official Gazette of the United States Patent Office, Vol 988, No 1, p 103, November 6, 1979.

Descriptors: *Patents, *Irrigation, *Application equipment, *Flow control, Irrigation practices, Irrigation efficiency, Irrigation operation and maintenance, Drip irrigation.

The fluid flow control devices described are particularly useful as drip irrigation emitters provided with flow regulation to reduce their pressure-sensitivity, enabling them to be used in long lines and in undulating terrain. The disclosed devices include a first flexible plastic strip bonded on one surface to a second plastic strip along bond lines defining a pressure-dropping passageway. A third plastic surface is bonded to the opposite surface of the first flexible plastic strip along bond lines defining a static pressure chamber in which the first flexible plastic serves as a common wall with the chamber and the passageway for at least part of the length of the passageway. Thus variations in the velocity of the fluid through the pressure-dropping passageway causes the common wall to be flexed to vary the cross-sectional area of the passageway and to regulate the fluid flow. Both linear-source emitters and point-source emitters are described. (Sinha-OEIS)
W80-03604

REBORN FEDERALISM IN WESTERN WATER LAW: THE NEW MELONES DAM DECISION,
For primary bibliographic entry see Field 6E.
W80-03795

BREATHING NEW LIFE INTO SECTION 8 OF THE 1902 RECLAMATION ACT: CALIFORNIA V. UNITED STATES,
For primary bibliographic entry see Field 6E.
W80-03814

LITIGATION OF THE RECLAMATION LAW IN THE IMPERIAL VALLEY: WHO HAS STANDING TO CHALLENGE WHICH LAW,
R. J. Michael.
California Water Law Review, Vol 14, No 3, p 563-589, 1979.

Descriptors: *California, *Federal reclamation law, *Irrigation programs, Judicial decisions, Federal jurisdiction, Agriculture reclamation, Water law, Legal aspects, Federal government, Legislation.

Since the early 1900's, the federal government has joined private efforts to improve agricultural reclamation in the Imperial Valley of California. Today, the government's involvement in the irrigation project is the object of judicial interpretation. One difficult issue is who has standing to challenge the various sections of reclamation law. The United States (U.S.) Supreme Court has recently tightened traditional standing requirements in the decisions of Worth v. Seldin and Simon v. Eastern Kentucky Welfare Rights Organization. The U.S. Ninth Circuit Court of Appeals has applied these standing requirements to efforts to challenge the 1902, Reclamation Act. In case of U.S. v. Imperial Irrigation District, the Court resolved the acreage limitation issue, but the Court refused to hear the residency requirements issue. Consequently the plaintiffs were denied access to the federal courts to challenge the nonenforcement of the Act. The present conflicts in the reclamation law should be resolved by congressional clarification instead of judicial interpretation. The Act's residency requirement and acreage limitations have not been amended since 1926. If not clarified the underlying purpose of the 1902 Reclamation Act assisting the family farmer will have been subverted. (Wilson-Florida)
W80-03888

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

THE ANTICIPATED DECISION INFLUENCE PERIOD IN REAL TIME RESERVOIR OPERATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6A.
W80-03645

HARPER SEEKS CLIMATE CONTROL WITH SPRINKLED VEGETABLES,
For primary bibliographic entry see Field 2I.
W80-03658

AEROMONAS DISTRIBUTION AND SURVIVAL IN A THERMALLY ALTERED LAKE,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.
C. B. Fliermans, R. W. Gorden, T. C. Hazen, and G. W. Esch.
Applied and Environmental Microbiology, Vol 33, No 1, p 114-122, January 1977. 11 Fig, 3 Tab, 15 Ref.

Descriptors: *Heated water, *Fish parasites, *Fish populations, *Water pollution effects, *Epizootiology, Aeromonas hydrophila, Thermal pollution, Par Pond(SC), Nuclear reactors, Fishkill, Pest control, Water temperature, Distribution, Cooling water, Epizoites, Mortality, Aquatic bacteria, Dissolved oxygen.

The survival and distribution of Aeromonas hydrophila in heated natural waters was studied August 1975-1976 in Par Pond, a monomictic lake used as a cooling reservoir for a production nuclear reactor at Savannah River Plant, Aiken, South Carolina. Although it is unclear whether aeromonad survival in Par Pond is due directly to thermal inputs or indirectly related to flow rates and/or nutrient distributions caused by reactor operations, it is clear that aeromonads are ubiquitous throughout the pond and that bass populations are heavily infected by these etiological agents of red sore disease. Aeromonas is commonly pathogenic to fish, frogs, reptiles and humans. Fish populations in the lake have lesions of epizooty from which Aeromonas spp. are readily isolated. Distribution and population densities of this ubiquitous aquatic bacterium were measured seasonally in the water column along an oxygen and temperature gradient. Greater Aeromonas densities occur below the oxygen chemocline when the reservoir is stratified. Survival levels of pure A. hydrophila cultures correspond to distribution patterns of naturally occurring Aeromonas-like populations. Greater survival of A. hydrophila during full reactor operation suggests that fish populations may be exposed to Aeromonas for a longer period of time than when the reactor is not operating. (Harris-Wisconsin)
W80-03787

SEASONAL CHANGES OF BACTERIOPLANKTON IN A RESERVOIR RELATED TO ALGAE. I. NUMBERS AND BIOMASS,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
For primary bibliographic entry see Field 5C.
W80-03811

MANAGEMENT OF ELODEA IN AUSTRALIAN IRRIGATION SYSTEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
K. S. Bowmer, G. R. Sainty, G. Smith, and K. Shaw.
Journal of Aquatic Plant Management, Vol 17, p 4-12, June 1979. 2 Fig, 5 Tab, 53 Ref.

Descriptors: *Irrigation canals, *Australia, *Herbicides, *Aquatic weed control, Irrigation, Irrigation ditches, Irrigation systems, Aquatic plants, Submerged plants, Aquatic weeds, Plant growth regulators, Ammonia, Economics, Environmental effects, Management, Aromatic compounds, Ecology, Plant populations, Distribution.

Obstructuve elodea weed growth in Australian irrigation canals is temporarily controlled by injection of the herbivide acrylaldehyde (acrolein) and aromatic solvents or ammonia into flowing water; however, major research emphasis is on finding more economical and permanent controls. Other treatments considered economical for smaller irrigation canals include short-term, high-concentration injections of endothal alkylamine salts and simazine applications after canal drainage. However, acrolein is the only herbicide suitable for larger irrigation canals for reasons of convenience, economy, and safety. Chlorfenac is exceptionally effective for longer control and eradication, but due to its water solubility it is not available. Dichlobenil is only moderately effective and is expensive. Placement techniques and slow-release formulations

with alginates, polymers or invert emulsions may make other aquatic weed control methods available in the future. Elodea is not effectively controlled by non-chemical methods. Elodea is a native plant of North America; it was first noticed in Southeast Australian irrigation systems in 1957-1958 and is particularly troublesome in larger supply and drainage canals which carry water throughout the irrigation season. Elodea is a submerged perennial plant which thrives in temperate climatic zones. In Australia, it survives the winter in moist situations in a semidormant state. (Danovich-Wisconsin)
W80-03825

ASSESSMENT OF AQUATIC WEED PROBLEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
D. S. Mitchell.
Journal of Aquatic Plant Management, Vol 17, p 19-21, June 1979. 1 Tab, 5 Ref.

Descriptors: *Aquatic weed control, *Data collections, *Analytical techniques, Ecology, Aquatic weeds, Economics, Size, Computer programs, Data processing, Developing countries, Decision-making, Inspection, Surveys, Testing procedures, Plant populations, Plant growth, Sites, Invasion.

A field assessment form for aquatic weed control characterizes the site, identifies weeds, assesses their nuisance status and appraises potential to promote or inhibit water quality. The field assessment form is useful for aquatic weed evaluations to be carried out systematically and objectively particularly in developing countries, since the sole assessment criteria in many cases is weed population size. The suggested form encompasses main data types likely to be important in full problem evaluation. The assessment form includes evaluation of ecological and economic factors on a quantitative basis and data is suitable for computer storage and analysis. Coding is employed for data such as type of water body, weed introduction method, and species name. Aquatic weed ecology factors include hydrological regime stability, nutrient status, climatic conditions, plant growth and reproduction potential, plant effects on environmental physicochemical and biotic factors and whether plants are alien species. An essential requirement for predicting increase in weed population size is an estimate of plant growth rate in the conditions present at the infestation site. Plant vigor, as shown by health and size, indicates site suitability. Temperature and nutrient availability varies seasonally, therefore, it is undesirable to measure growth rates at the most favorable and unfavorable seasons. (Danovich-Wisconsin)
W80-03826

A NEW APPROACH FOR SALVINIA CONTROL,
Queensland Dept. of Lands, Brisbane (Australia).
G. Diatloff, A. N. Lee, and T. M. Anderson.
Journal of Aquatic Plant Management, Vol 17, p 24-27, June 1979. 3 Fig, 2 Tab, 14 Ref.

Descriptors: *Herbicides, *Aquatic weed control, *Surfactants, *Salvinia, Chemcontrol, 2,4-D, Aquatic plants, Aquatic weeds, Environmental effects, Oil, On-site tests, Sulfonates, Floating plants, Kerosene, Toxicity, Water hyacinth, Australia.

Experiments show that a mixture of 20 g diuron and 150 g calcium dodecylbenzene sulfonate per liter of formulation with acetone and kerosene as cosolvents completely controls the aquatic weed salvinia. The above mixture is diluted 1 to 10 with kerosene and is available in Australia for large scale experimental purposes under the code name AF 101. Kerosene phytotoxic properties were recognized for many years but its ability to spread out as a very thin layer on water was limited. Oil-soluble surfactant calcium dodicylbenzene sulfonate additions in low concentrations to kerosene greatly increases it spread over both water and salvinia emergent fronds. The surfactant at 1.5%-2.0% W/V gives significantly better results than at lower concentrations. Additions of herbicides, 2,4-D and dishlorprop significantly improve kerosene/surfactant effects, but do not give complete control. Herbicide diuron additions at all levels give complete control. AF 101 is also successful for large scale experimental treatment of red azolla and water lettuce. Formula modification to incorporate 2,4-D instead of diuron completely controls water hyacinth problems. Submersed species are unaffected by the floating herbicide. Water contamination following AF 101 application is minimal implying that this technique is environmentally acceptable. (Danovich-Wisconsin)
W80-03827

THE USE OF MULTIPLE INVERSION AND CLEAN-FLO LAKE CLEANSER IN CONTROLLING AQUATIC PLANTS,
Clean-Flo Labs., Inc., Hopkins, MN.
R. L. Laing.
Journal of Aquatic Plant Management, Vol 17, p 33-38, June 1979. 7 Fig, 6 Tab, 9 Ref.

Descriptors: *Aquatic weed control, *Destratification, *Nutrient removal, *Crystal Lake(MN), Edina Pond(MN), Peavey Lake(MN), Aquatic plants, Aquatic weeds, Chemcontrol, Turnovers, Water circulation, Nutrients, Pondweeds, On-site tests, Chemical precipitation, Submerged plants, Plant growth regulators, Plant growth, Plant populations, Filamentous algae, Algae.

Monitoring of effects of Multiple Inversion and Clean-Flo Lake Cleanser upon aquatic plant communities in three Minnesota lakes June-October 1974 shows that in the long-term, submergent plants will probably respond to nutrient reduction. A Multiple Inversion system introduces microscopic bubbles into the bottom water, inducing turnover. Clean-Flo Lake Cleanser, a soluble calcium compound, accelerates phosphorus removal. Crystal Lake has 29.5 ha area and 10.7 m maximum depth. Edina Pond, 2.4 ha, serves as a storm sewer reservoir and has 1.0 m average depth and 2.0 m maximum depth. Peavey Lake has 2.6 ha area, is 27.4 m deep and is connected to 6444 ha Lake Minnetonka by a 100 m long channel. Until 1970, Peavey served as a sewage settling pond. Edina Pond responded least to treatment since it was completely flushed with storm water runoff after treatment. In Crystal Lake, filamentous algae completely disappeared after treatment but temporary regrowth occurred after heavy rains Flatstem pondweed declined 79% in Crystal Lake, but then recovered completely after June rains. Peavey Lake, treated after the rains, had an immediate 99% decline in filamentous algae compared to controls. After repeated treatment the following year, flatstem pondweed and filamentous algae were controlled 90-100% in Crystal Lake and coontail, Berchtold's pondweed, western pondweed, and filamentous algae were controlled 90-100% in Edina Pond. (Danovich-Wisconsin)
W80-03828

ESTABLISHMENT OF WATERHYACINTH WEEVIL POPULATIONS IN LOUISIANA,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
J. H. Manning.
Journal of Aquatic Plant Management, Vol 17, p 39-41, June 1979. 1 Fig, 1 Tab, 6 Ref.

Descriptors: *Water hyacinth, *Louisiana, *Aquatic weed control, *Biocontrol, *Plant growth regulators, Herbicides, 2,4-D, Aquatic plants, Aquatic weeds, Hosts, Integrated control measures, Biological treatment, Chemcontrol, Swamps, Insects, Population, Reproduction, Vegetative reproduction.

After two water hyacinth weevil species (Neochetina eichhorniae and Neochetina bruchi) were introduced in Louisiana in 1974, water hyacinth vegetative reproduction stress was observed. Flowering at Sorrento and Alexandria, nursery areas for N. eichhorniae weevils, was reduced in 1976. Damage by N. eichhorniae and the severe 1977 winter combined to elimate water hyacinth plants from Sorrento. N. bruchi populations are increasing but are presently being invaded by N. eichhorniae. Pure N. bruchi populations probably cannot be established in Louisiana to be used for collection and release on a large scale basis. The Louisiana Department of Wildlife and Fisheries is optimistic that both weevil species are aiding water hyacinth control programs, especially in areas inaccessible to herbicide spray crews. Aerial surveys in November 1977 disclosed an estimated 480,000 ha of water hyacinth in Louisiana. Much of this infestation occurs in dense South Louisiana swamps, where access by spray crews is limited by 5 cm-0.6 m water levels. Chemical control with 2,4-D began in 1946 and continues today. However, to control water hyacinth in inaccessible swamp areas, host-specific biological agents, two species of South American weevil, were introduced. (Danovich-Wisconsin)
W80-03829

BIOLOGICAL CONTROL OF HYDRILLA VERTICILLATA ROYLE WITH GRASS CARP (CTENOPHARYNGODON IDELLA VAL),
University of Central Florida, Orlando. Dept. of Biological Sciences.
J. A. Osborne, and N. M. Sassic.
Journal of Aquatic Plant Management, Vol 17, p 45-48, June 1979. 3 Fig, 4 Tab, 18 Ref.

Descriptors: *Biocontrol, *Carp, *Fish establishment, *Aquatic weed control, *Little Lake Barton(FL), *Fish stocking, Aquatic plants, Aquatic weeds, Integrated control measures, Plant growth regulators, Biomass, Plant growth, Water temperature, Primary productivity, On-site tests, Fish populations, Fish diets, Number fish per acre, Management.

Stocking of grass carp was the major factor in a decline of hydrilla during October 1976-October 1978 in Little Lake Baront, Florida. Annual mean hydrilla biomass was 1.700 kg fr wt/sq m for 1976-1977 and 0.923 kg fr wt/sq m for 1977-1978, representing an annual 45.7% decrease in biomass. Net primary productivity was -8.0 g/sq m/d for 1976-1977 and -22.0 g/sq m/d for 1977-1978 or approximately three-fold lower during the second study year. Hydrilla biomass in October, 1977 was 22.1% lower than in October, 1976; hydrilla biomass in October, 1978 was 55.5% lower than in October, 1977. Hydrilla biomass leveled off when it reached 2.2 kg fr wt/sq m in August, 1977, while it reached only 1.012 kg wt/sq m by October, 1978. Although the lowest temperature occurred during the second year, seasonal trends were similar between study years. Little Lake Barton, Orange County, Florida with 1.63 m mean depth, is a 5.42 ha solution basin which has had hydrilla infestation since 1971. Initial grass carp stocking in October 1976 consisted of 32 fish/ha with 2.6 kg/ha mean weight. During August 1977 a fish kill occurred and in October 1977, 15 fish/ha were placed in the lake. Selective grass carp removal at the end of two years provided a 13 fish/ha population estimate and 90.13 kg/ha biomass. (Danovich-Wisconsin)
W80-03830

TAXONOMIC CHARACTERISTICS OF AQUATIC PLANTS FROM THE ALIMENTARY TRACT OF GRASS CARP,
Florida State Game and Fresh Water Fish Commission, Eustis. Eustis Fisheries Research Lab.
C. C. Carter, and R. S. Hestand.
Journal of Aquatic Plant Management, Vol 17, p 49-53, June 1979. 10 Fig, 7 Ref.

Descriptors: *Classification, *Carp, *Aquatic weed control, *Digestion, *Plant tissues, Systematics, Aquatic plants, Animal physiology, Biodegradation, Food habits, Diets, Plant morphology, Plant physiology, Vascular tissues, Plant groupings, Leaves, Speciation, Macrophytes, Algae.

This paper constructs a taxonomomic key to help identify various plant species ingested by grass carp. Key characters in identifying macrophytes when masticated are included. Ten aquatic macrophytes and one high algae were selected for investigation: Brazilian elodea, hydrilla, eelgrass, pondweed, cabomba, Eurasian watermilfoil, common bladderwort, southern naiad, coontail, dwarf arrowhead and muskgrass. Larger pondweed fragments are obtained in the analysis; however, the

long and narrow thread-like capillary divisions of fanwort and Eurasian watermilfoil are easier to identify. These thread-like divisions are discernible and apparently pass through the mastication process almost intact. Plants with longer, broader leaves such as pondweed and eelgrass, suffer more damage in the grinding process. Discernible fragment characters are found for all hydrophytes investigated except common bladderwort where fragments are ground beyond recognition. Coontail leaf apex is rounded to truncate with two spines located an equal distance from apex producing a horned-like appearance. Minute subtle character differences are found between elodea and hydrilla. Brazilian elodea leaves exhibit a distinct smooth margin and surface texture and have small marginal teeth pointing forward. Hydrilla leaves exhibit a distinct scabrous or harsh marginal and surface texture and bear minute teeth directed outward. (Danovich-Wisconsin)
W80-03831

EFFECTS OF MECHANICAL CUTTING ON SUBMERSED VEGETATION IN A LOUISIANA LAKE,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
R. E. Johnson, and M. R. Bagwell.
Journal of Aquatic Plant Management, Vol 17, p 54-57, June 1979. 3 Fig, 3 Tab, 5 Ref.

Descriptors: *Mechanical control, *Harvesting, *Aquatic weed control, *Lake Bistineau(LA), *Black Bayou Lake(LA), Aquatic weeds, Aquatic plants, Biomass, Submerged plants, Plant growth, Costs, Plant growth regulators, Root development, Rooted aquatic plants, Eutrophication, Plant populations, Management, Control, Vegetation regrowth, Cutting management.

Large scale mechanical cutting of submersed vegetation in Louisiana reservoirs is not feasible. The limited period of control gained by cutting vegetation is offset by the comparatively slow machine operation rate. Using mechanical cutting machines to open or maintain boat roads through rooted, submersed vegetation could be beneficial; however, the area cut would have to be extremely large for cost/ha figures to be economically feasible. Costs for 86 operating days during the 1975 season on Lake Bistineau, Louisiana, amounted to $34.27/ha. Operating and maintenance expenses for this time period were $1,081 and labor costs were $1,541. Annual depreciation on equipment was $2,284 and down-time was 34.5% of project time cost. Vegetation cut in May was near the surface again in late August, indicating only temporary control over submersed rooted vegetation. On Black Bayou Lake, average egeria, coontail and bladderwort biomass varied 1036-1712 g/sq m in July 1975. Two months after cutting, biomass varied 834-1388 g/sq m. Regrowth from rooted plants began immediately and continued until September. Average regrowth length varied 29-30.5 cm. In order to evaluate egeria cutting survival, 500 cuttings were introduced into sample plots; 365 new plants were produced indicating that serious problems with new aquatic weed infestations could occur in non-infested portions of a water body by cut plant fragments movements. (Danovich-Wisconsin)
W80-03832

MECHANICAL HYDRILLA CONTROL IN ORANGE LAKE, FLORIDA,
Army Engineer District, Jacksonville, FL.
J. T. McGehee.
Journal of Aquatic Plant Management, Vol 17, p 58-61, June 1979. 1 Fig.

Descriptors: *Mechanical control, *Harvesting, *Aquatic weed control, *Orange Lake(FL), Aquatic weeds, Aquatic plants, Biomass, Plant growth, Costs, Cutting management, Plant growth regulators, U.S. Army Corps of Engineers, Equipment, Integrated control measures.

Aqua-Trio equipment controlled Hydrilla in 65 ha of Orange Lake, Florida for four months in 1977; this included 42 km of trail and 14 use areas. During this period 1100 loads of hydrilla were cut and disposed of either in openwater disposal areas or on upland. Load weights ranged 776-1869 kg indicating that 1,452,500 kg of hydrilla were removed. Total costs were $73,200; cost/ha was $1,125 for the full period. Costs are competitive with chemical control methods. Disposing cut vegetation in lake shallows and increasing the time between recuts can effectively double the work that can be performed. In areas of almost complete infestation, mechanical systems are effective tools in intergrated hydrilla control. Equipment results are direct and immediate. Orange Lake is located in north central Florida and has a 5,261 ha surface area. It is historically a prime fishing lake for largemouth bass and bream. The lake was over 90% infested with hydrilla in 1976. (Danovich-Wisconsin)
W80-03833

SEASONAL VARIATION IN THE BIOMASS, TUBER DENSITY, AND PHOTOSYNTHETIC METABOLISM OF HYDRILLA IN THREE FLORIDA LAKES,
Florida Univ., Gainesville. Dept. of Botany; and Florida Univ., Gainesville. Dept. of Agronomy.
For primary bibliographic entry see Field 5C.
W80-03834

BRITISH COLUMBIA AQUATIC PLANT MANAGEMENT PROGRAM,
Department of the Environment, Victoria (British Columbia).
P. R. Newroth.
Journal of Aquatic Plant Management, Vol 17, p 12-19, June 1979. 3 Fig, 4 Tab, 24 Ref.

Descriptors: *Okanagon Valley, British Columbia, Canada, *Herbicides, Aquatic weed control, *Mechanical control, *Eurasian watermilfoil, Aquatic plants, Aquatic weeds, Lakes, Plant populations, Distribution, Plant growth regulators, Harvesting, Chemcontrol, 2,4-D, Water management(Applied), Project planning, Institutions, Administration, Control.

Main components of the British Columbia Aquatic Plant Management Program are: survey, mapping and documentation of Eurasian watermilfoil (Myriophyllum spicatum); ecological research; mechanical and chemical control technology evaluation; and attempts at containment and quarantine. Since 1975 detailed mapping of Eurasian watermilfoil populations has been performed and by 1977 this plant occupied 580 ha in Ikanagan Valley mainsten lakes, British Columbia. Approximately 205 ha were treated by mechanical methods in 1978. Equipment includes harvesters, rotovators, and small diver-operated suction dredges. Rotovators operate over a much longer season than harvesters; however, their speed is slow and costs are high compared to harvesting. Small diver-operated suction dredges are particularly valuable in removing plants adjacent to water intakes, around docks, breakwaters and other obstacles. Because of high diver pay rates and slow operation speed, these units are practical only in small new infestation areas. Fragments generated by harvesters and rotovators must be contained by floating barriers deployed around machine operation to prevent regrowth and further Eurasion watermilfoil expansion. Herbicide 2,3-D is effective and kills plant roots in most treatments. However, permits must be obtained to ensure that levels are below 0.001 ppm near public water intake systems. Buffer zones of 200-1500 m between treatment areas and active water intakes are recommended. (Danovich-Wisconsin)
W80-03840

FORMULATING AQUATIC WEED MANAGEMENT PROGRAMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
D. S. Mitchell.
Journal of Aquatic Plant Management, Vol 17, p 22-24, June 1979. 2 Tab, 7 Ref.

Descriptors: *Aquatic weed control, *Cost-effectiveness, *Cost-benefit analysis, *Analytical techniques, *Economics, Aquatic plants, Aquatic weeds, Management, Water management(Applied), Costs, Environmental effects, Methodology, Decision-making, Multiple-purpose projects, Evaluation, Testing procedures, Aesthetics.

Cost-effectiveness analysis provides a framework for systematic evaluation of both quantifiable and non-quantifiable data relevant to aquatic weed management. This approach is merited when expensive control measures are needed in complex situations. Cost-effectiveness analysis is a systematic method of selecting alternatives by rational evaluation and cost and effectiveness comparisons. Cost-effectiveness characteristics are: (1) objectives are carefully formulated and unambiguously stated; (2) both non-quantifiable and quantifiable factors are considered; (3) judgements based on experience are employed in the analysis; (4) alternative courses of action are explicitly evaluated; (5) alternative selection is based either on fixed costs or fixed effectiveness; and (6) all factors required to reach a sound decision are objectively displayed for the decision-maker. Weighting criteria may also be assigned by pair comparisons and sensitivity analysis may be performed on the tabulated data. A simplified cost-benefit analysis approach is also outlined. Its major disadvantage is that all factors are evaluated in commensurate money units; this is difficult for ecological and aesthetic benefits or detriments. It is also difficult to estimate, in financial terms, adverse effects of aquatic weed control measures. (Danovich-Wisconsin)
W80-03841

THE ANALYSIS OF RISK IN IRRIGATION PROJECTS IN DEVELOPING COUNTRIES,
University of East Anglia, Norwich (England). School of Developmental Studies.
For primary bibliographic entry see Field 6B.
W80-03851

4B. Groundwater Management

PROCEEDINGS OF THE TWELFTH BIENNIAL CONFERENCE ON GROUNDWATER, SACRAMENTO, SEPTEMBER 20-21, 1979.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151186, Price codes: A10 in paper copy, A01 in microfiche. California University, Davis, Water Resources Center Report No 45, November 1979. 209 p, 56 Fig, 21 Tab, 3 Append.

Descriptors: *Groundwater, *Groundwater management, *Groundwater potential, *Groundwater basins, *Groundwater availability, *Groundwater recharge, *Groundwater resources, *California.

This conference concentrated on groundwater and groundwater management in California. Many aspects of groundwater management are examined including water rights, legal aspects, storage, pollution, public policy, recharge and conjunctive use of groundwater and surface water. (Snyder-Calif)
W80-03641

THE ECONOMIC CONSEQUENCES OF ALLOCATING GROUNDWATER TO COMPETING INTEREST IN THE SANTA CRUZ BASIN, PIMA COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6E.
W80-03707

DEVELOPMENT OF GROUND WATER IN THE HOUSTON DISTRICT, TEXAS, 1970-74,
Geological Survey, Austin, TX. Water Resources Div.
R. K. Gabrysch.
Texas Department of Water Resources Report 241, January 1980. 49 p, 22 Fig, 6 Tab, 22 Ref.

Descriptors: *Groundwater, *Withdrawal, *Water supply, *Water level fluctuations, *Aquifer man-

agement, *Drawdown, Water quality, Saline water intrusion, Water resources development, Aquifer characteristics, Texas, *Houston district, Chicot aquifer, Evangeline aquifer, *Harris County(Tex), *Galveston County(Tex).

Total withdrawals of ground water in the Houston district, Texas, increased 9 percent from about 488 million gallons per day in 1970 to about 532 million gallons per day in 1974. The average annual rate of increase from 1960 to 1969 was about 6.3 percent. During 1970-74, increases in pumpage occurred in the Houston, Katy, and NASA areas; decreases occurred in the Pasadena and Alta Loma areas; and the pumpage in the Baytown-La Porte and Texas City areas remained almost constant. Water levels continued to decline throughout the district during 1970-74, but the rate of decline generally was not as great as in previous years. The greatest declines in the past several years were in the Houston area, but the center of decline is still in the Pasadena and Baytown-La Porte areas. The decrease in the rate of decline suggests that the aquifers in the Houston district could support the amount of pumping during 1970-74 with little, if any, further decline. Although saltwater encroachment has probably occurred in the district, particularly in Galveston County, no large increases in chloride were measured at the monitoring points. (Kosco-USGS)
W80-03768

REBORN FEDERALISM IN WESTERN WATER LAW: THE NEW MELONES DAM DECISION,
For primary bibliographic entry see Field 6E.
W80-03795

BREATHING NEW LIFE INTO SECTION 8 OF THE 1902 RECLAMATION ACT: CALIFORNIA V. UNITED STATES,
For primary bibliographic entry see Field 6E.
W80-03814

LITIGATION OF THE RECLAMATION LAW IN THE IMPERIAL VALLEY: WHO HAS STANDING TO CHALLENGE WHICH LAW,
For primary bibliographic entry see Field 3F.
W80-03888

4C. Effects On Water Of Man's Non-Water Activities

EROSIONAL ASPECTS OF MANAGING URBAN STREAMS,
Rutgers - The State Univ., New Brunswick, NJ. Water Resources Research Inst.
For primary bibliographic entry see Field 2J.
W80-03773

4D. Watershed Protection

SOIL AND WATER LOSSES FROM CORN-SOYBEAN ROTATIONS,
Science and Education Administration, Ames, IA.
For primary bibliographic entry see Field 2J.
W80-03725

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
J. V. Hunter.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 73-83, 1978. 25 Ref.

Descriptors: *Water quality, *Biochemical oxygen demand, *Mathematical models, *Laboratory tests, Rivers, Measurement, Kinetics, Oxygen demand, Dissolved oxygen, Model studies, Mathematics, Analytical techniques, Methodology, On-site tests, Analysis, Aquatic environment, Benthal oxygen demand, Sediment oxygen demand.

As a measure of effluent and receiving water organic matter content, the BOD determination has been justifiably criticized. However, it is the only determination that indicates the oxygen consumptive capacities of organics in receiving water. The problems associated with the determination involve the mathematical description of the kinetics, extrapolation to actual stream conditions, and, in common with the benthal oxygen demand, difficulty in separating photosynthetic respiration from actual net oxygen consumption. (See also W80-03606) (Humphreys-ISWS)
W80-03612

ALGAL GROWTH POTENTIAL--LOWER WILLAMETTE RIVER, OREGON,
Portland State Univ., OR. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W80-03614

TRACE ELEMENT LOADING OF SOUTHERN LAKE MICHIGAN BY DRY DEPOSITION OF ATMOSPHERIC AEROSOL,
Governors State Univ., Park Forest South, IL. Coll. of Environmental and Applied Sciences.
For primary bibliographic entry see Field 5B.
W80-03621

PARTICLE REWORKING IN SEDIMENTS FROM THE NEW YORK BIGHT APEX: EVIDENCE FROM 234TH/238U DISEQUILIBRIUM,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 2J.
W80-03629

THE EFFECT OF THE DEGREE OF MINERALIZATION OF WATER ON PHYTOPLANKTON,
Gosudarstvennyi Nauchno-Issledovanii Inst. Ozernogo i Rechnogo Rybnogo Khozyaistva, Gorkii (USSR). Gorkii Lab.
L. I. Pushchina.
Hydrobiological Journal, Vol 14, No 4, p 99, 1978.

Descriptors: *Phytoplankton, *Salinity, *Dominant organisms, Habitats, Water chemistry, Adaptation, Aquatic algae, Diatoms, Cyanophyta, Biomass, Salt tolerance, Seasonal, Ponds, Agriculture.

The algal flora in fish-breeding ponds was studied. Despite differences in salinity more than 40 species of algae were common to all the ponds. The number of Protococcaceae species decreased with increasing salinity. The Euglenophyceae and Volvocaceae were mainly freshwater forms found predominantly under conditions of minimum salt content. The content of dissolved salts also affects the quantitative development of the algae. The mean seasonal biomass of the phytoplankton was greatest in ponds with the lowest water salinity and least in those with the highest salinity. (Deal-EIS)
W80-03664

A PERIPHYTON GROWTH SUBSTRATE USEFUL FOR NUTRIENT IMPACT STUDIES IN LARGE RIVERS,
Saskatchewan Dept. of the Environment, Regina.
D. T. Waite.
Water Research, Vol 13, p 1347-1349, 1979. 2 Fig, 1 Tab, 1 Ref.

Descriptors: *Research equipment, *Periphyton, *Monitoring, Sewage effluents, Growth rates, Water quality, Rivers, Flow rates, Methodology, Nutrients, *Artificial substrates, *Substrates.

In order to facilitate the study of the effects of point source nutrient releases on large rivers a specialized substrate holder was devised. In field testing periphyton growth was analyzed under a variety of water conditions. The substrate rafts performed well in a wide range of water speeds. A schematic drawing of and materials list for the substrate holder are provided. (Deal-EIS)
W80-03665

RANGIA CUNEATA IN AN INDUSTRIAL WATER SYSTEM (BIVALVIA: MACTRIDAE),
Delaware Univ., Lewes. Coll. of Marine Studies.
C. L. Counts, III.
The Nautilus, Vol 94, No 1, p 1-2, 1980. 4 Ref.

Descriptors: *Clams, Fouling, *Water supply, Spatial distribution, Habitats, Delaware River, Chesapeake Bay, Ecological distribution, Migration, Benthic fauna, Oil refinery, *Rangia.

Rangia cuneata is commonly found in fresh and brackish coastal waters from Chesapeake Bay to Texas. This paper reports on the first appearance of R. cuneata in Delaware Bay. Adult specimens were collected from the water system of an oil refinery. It is assumed that the clams migrated through the Chesapeake-Delaware Canal which connects northern Chesapeake Bay with the Delaware River. The biofouling problems created by the clam are discussed. (Deal-EIS)
W80-03669

AN ARTIFICIAL MICROBIAL ECOSYSTEM FOR DETERMINING EFFECTS AND FATE OF TOXICANTS IN A SALT-MARSH ENVIRONMENT,
Environmental Research Lab., Gulf Breeze, FL.
A. W. Bourquin, M. A. Hood, and R. L. Garnas.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-277 181, Price codes: A02 in paper copy, A01 in microfiche. Development in Industrial Microbiology, Vol 18, p 185-191, 1977. 4 Fig, 1 Tab, 13 Ref. EPA-600/J-77-075.

Descriptors: *Research equipment, *Bioassay, *Bacteria, *Salt marshes, Laboratory tests, Laboratory equipment, Metabolism, Mode of action, Toxicity, Radioisotopes, Radiochemical analysis, Tracers, Microbial degradation, Monitoring, Methodology, *Parathion.

An artificial laboratory environment designed to determine microbial interactions with pollutant chemicals is proposed. The system is designed to obtain maximum reproducibility between replicates by dividing a single tank into separate closed chambers. Radiolabeled toxicants are added directly to the core-chambers and monitored for metabolic breakdown. Further information is obtained easily on changes in microbial, physiological indexes induced by the toxicants. Techniques for monitoring effects on the methyl parathion on the microbial population and the fate of this chemical are given. (Deal-EIS)
W80-03670

COMPARISON OF VARIOUS METHODS FOR ESTIMATING THE QUALITY OF WATER BASED ON BOTTOM-DWELLING INDICATOR INVERTEBRATES,
Ukranian Hydrobiology Inst. Kherson (USSR). Kherson Hydrobiological Station.
T. G. Moroz.
Hydrobiological Journal, Vol 14, No 3, p 96-99, 1978. 1 Tab, 11 Ref.

Descriptors: *Bioindicators, *Analytical techniques, *Water quality, Benthic fauna, Rivers, Methodology, Monitoring, Mathematical models, Oligochaetes, Diptera, Mollusks, Aquatic insects, Dniepr River.

The application of a number of methods for the monitoring of pollution on various sections of the Lower Dniepr has made it possible to recommend the method of Gudnight and Whitley, which should be further perfected in accordance with the Drachev classification adopted in the Soviet

Union. Reasons are given why other methods described in the literature cannot be used for rivers of this type. (Deal-EIS)
W80-03673

QUANTITATIVE EXTRACTION OF CHLORINATED ORGANIC PESTICIDES AND POLYCHLORINATED BIPHENYLS FROM FISH ORGANS AND TISSUES,
Institute of Experimental Meteorology Obrinsk (USSR).
E. I. Babkina, and T. I. Bobovnikova.
Hydrobiological Journal, Vol 14, No 3, p 85-87, 1978. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Chemical analysis, *Methodology, *Solvents, Analytical techniques, Testing procedures, Chemical properties, Pesticide kinetics, Chlorinated hydrocarbon pesticides, Polychlorinated biphenyls, Gas chromatography, *Tissue analysis.

A relationship is shown to exist between the extracting agent and the rate of extraction of chlorinated organic pesticides (COP) and polychlorinated biphenyls (PCB). Maximum extraction can be achieved only with polar solvents (acetone, esters, alcohols), followed by redistribution of the pesticides from these solvents into nonpolar solvents (hexane, petroleum ether). A method is proposed for the separate determination of COP and PCB in fish organs and tissues. The sensitivity of this method is equal to 0.001-0.006 mg/100 g fish oil for COP and 0.01-0.02 mg/100 g fish oil for PCB. The detection of COP and PCB amounts to 70-90%. (Deal-EIS)
W80-03674

A METHOD FOR STUDYING THE EXCRETORY FUNCTION OF FISH KIDNEYS UNDER CHRONIC EXPERIMENTAL CONDITIONS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
V. D. Romananko, and N. I. Kotsar.
Hydrobiological Journal, Vol 14, No 3, p 99-101, 1978. 2 Fig, 7 Ref.

Descriptors: *Analytical techniques, *Fish physiology, *Methodology, Laboratory tests, Testing procedures, Bioassay, Research equipment, Fish behavior, Aquaria, Sampling, *Fish kidney function, *Urinalysis.

A method is described for collecting urine samples in fish through a chronic bladder fistula applied in the abdominal wall region. The urine flowing through the fistula tube is collected in a special urine collector attached to the anal fin, from which it is taken out with a thin flexible tube, the free end of which is kept on the surface of the water with a float, while the other end is inserted into the urine collector. With the aid of the method proposed here, urine can be collected from free-swimming fish without taking them out of the water. (Deal-EIS)
W80-03675

VARIATION IN THE REACTIONS OF DAPHNIA MAGNA STRAUS TO THE EFFECT OF A TOXICANT AS RELATED TO ITS DELIVERY REGIME,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
S. N. Kushnikova.
Hydrobiological Journal, Vol 14, No 4, p 86-91, 1978. 2 Tab, 11 Ref.

Descriptors: *Toxicity, *Daphnia, *Bioassay, *Methodology, Organic compounds, Acids, Analytical techniques, Testing procedures, Mode of action, Chemical properties, *Acetic acid.

The reaction of Daphnia to interrupted and intermittent regimes of exposure to a toxicant may differ appreciably from the reactions to constant exposure. The choice of a constant regime in toxicological experiments is not apparently always justified, since the interrelationship between the organism and the poison are more complex than would appear on the basis of data obtained from stable exposure. At the maximum concentrations of the toxicant (acetic acid) the exposure regime does not have a significant influence on Daphnia. The strength of the stimulating or inhibiting action of the toxicant is largely dependent on the frequency with which the solutions are changed. An interrupted regime has a lesser toxic effect than an intermittent regime. (Deal-EIS)
W80-03676

THE RELATIONSHIP BETWEEN VERTEBRAL NUMBER AND WATER TEMPERATURE IN COD,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
K. Brander.
J. Cons int Explor Mer, Vol 38, No 3, p 286-292, 1979. 3 Fig, 2 Tab, 1 App, 15 Ref.

Descriptors: *Water temperature, *Growth rates, *Toxicity, Marine fish, Fish physiology, Fish populations, Animal growth, Atlantic Ocean, Thermal stress, Adaptation, North Atlantic, British Isles, *Cod, Tissue analysis, *Vertebrae.

An inverse relationship between water temperature during early development and mean vertebral number (VS, includes urostyle) is established for cod populations throughout the North Atlantic, but the extent to which differences in VS are inherited is unknown. The VS of different year classes of cod from the North Sea shows some dependence on water temperature and the year class should therefore be taken into account, where possible, when seeking evidence of separation between stocks. Values of VS for populations around the British Isles are plotted on the chart of mean March surface temperature and in general agree with the established temperature-VS relationship. Two areas for which the vertebral numbers seem anomalous are the English Channel and the north-east Irish Sea and these anomalies are discussed. (Deal-EIS)
W80-03680

A REVIEW OF THE LETHAL AND SUBLETHAL EFFECTS OF MERCURY ON AQUATIC LIFE,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Research Lab.
D. Taylor.
Residue Reviews, Vol 72, p 33-69, 1979. 6 Tab, 142 Ref.

Descriptors: *Mercury, *Toxicity, *Aquatic life, Mortality, Mode of action, Aquatic algae, Mollusks, Crustaceans, Freshwater fish, Salmonids, Water chemistry, Heavy metals, Water temperature, Salinity, Lethal limit, Bioassay, Chemical properties, *Bioavailability, *Methylmercury.

One hundred scientific papers published between 1937 and 1976 have been reviewed as part of an attempt to assess the environmental significance of mercury in natural waters. In general, the lethal effects on aquatic life of both inorganic and organic mercury compounds appear at concentrations greater than ten microg/l. Similarly, sub-lethal responses to inorganic mercury occur where concentrations are greater than three microg/l. Organic mercury is apparently more harmful, the corresponding concentration being greater than 0.1 microg/l. Aquatic algae and the larval stages of molluscs and crustaceans appeared to be the most sensitive organisms to mercury. The conclusions reached following investigations under controlled conditions in the laboratory do not necessarily apply in the natural environment and this is particularly true for mercury. Probably the most important factor to be considered is the form in which the mercury is present in the environment, since natural processes such as adsorption, precipitation, volatilisation, and complexation are likely to reduce the concentration of 'biologically available' mercury. In addition, antagonistic reactions may reduce its effect. (Deal-EIS)
W80-03683

IN VITRO INHIBITION OF THREE PHOSPHATASES BY MERCURIC CHLORIDE AND THEIR REVERSAL BY CHELATING AGENT EDTA,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
K. V. Sastry, and K. Sharma.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 741-746, 1979. 2 Tab, 23 Ref.

Descriptors: *Enzymes, *Inhibition, *Mercury, Phosphates, Organic compounds, Biochemistry, Proteins, Fish physiology, Animal metabolism, Heavy metals, Chelation, *EDTA, *Channa, *Tissue analysis.

In vitro studies revealed that mercury is quite effective in inhibiting the activities of three Channa punctatus brain enzymes (alkaline phosphatase, acid phosphatase, glucose-6-phosphatase). The degree of inhibition is directly proportional to the increase in the concentration of mercuric chloride in the culture medium. EDTA was found to be capable of restoring the activity of all three enzymes. The degree of restoration increased with the increase in EDTA concentration and time. (Deal-EIS)
W80-03685

COPPER TOXICITY TO THE BAY SCALLOP (ARGOPECTEN IRRADIANS),
Environmental Research Lab., Narragansett, RI.
For primary bibliographic entry see Field 5C.
W80-03689

THE EFFECTS OF THE ANAESTHETIC QUINALDINE ON OXYGEN CONSUMPTION IN AN INTERTIDAL TELEOST BLENNIUS PHOLIS (L.),
Plymouth Polytechnic (England) School of Environmental Sciences.
R. N. Dixon, and P. Milton.
Journal of Fish Biology, Vol 12, p 359-369, 1978. 3 Fig, 7 Tab, 32 Ref.

Descriptors: *Oxygen requirements, *Fish physiology, *Inhibition, *Organic compounds, Teleosts, Chemical properties, Mode of action, Respiration, Water chemistry, Animal metabolism, Marine fish, *Anaesthetics, *Quinaldine, *Blennius, Blennies.

The effects of the anaesthetic quinaldine on oxygen consumption in an intertidal teleost Blennius pholis (L) were investigated. Oxygen consumption generally decreases with increasing quinaldine concentration in environmental water. However, at low concentrations, oxygen consumption of smaller specimens is slightly increased. Generally, smaller specimens have their oxygen consumption affected less by a given quinaldine concentration than do larger specimens, as the former appear to be at less depressed stages of anaesthesia. This is thought to be due to smaller B. pholis becoming saturated with quinaldine more rapidly but simultaneously being afforded more rapid removal, because of their greater relative gill area per unit body volume. The reduction of oxygen consumption at high concentrations of quinaldine is great. (Deal-EIS)
W80-03690

THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 3. A SURVEY OF THE SEWAGE SLUDGE DISPOSAL AREA IN LYME BAY,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Directrorate of Fisheries Research.
R. A. Eagle, P. A. Hardiman, M. G. Norton, and R. S. Nunny.
Ministry of Agriculture, Fisheries & Food, Directorate of Fisheries Research, Fisheries Research Technical Report No 49, ISSN 0308-5589, Lowestoft, 1978. 22 p, 20 Fig, 3 Tab, 1 App, 30 Ref.

Descriptors: *Sludge disposal, *Heavy metals, *Biological communities, Dominant organisms, Bioindicators, Benthic fauna, Path of pollutants, Sewage disposal, *Mercury, *Copper, *Zinc, *Lead, *Nickel, *Chromium, Nutrients, Nitrogen, Phosphorus, Sewage bacteria, Particle size, Bottom sediments, *Species diversity.

The survey of the area in Lyme Bay used for the dumping of sewage sludge shows dispersion processes to be ineffective in preventing accumulations of dumped material in the sediments. Despite the small quantity of sludge dumped (62,000 m3/year) levels of carbon, nitrogen and trace metals such as mercury, copper, zinc, lead, nickel and chromium are significantly elevated in the area most commonly used for dumping. The addition of organic materials by dumping does not appear to have been utilised by any of the benthic species and there is no evidence of enrichment of numbers of individual species or of the number of species. In the zone most contaminated by dumping, however, there appeared to be a slight reduction in the number of species present, caused by the absence of some of the rarer species found in other parts of the survey area. (Deal-EIS)
W80-03696

EFFECTS OF TEMPERATURE AND SALINITY ON PRODUCTION AND HATCHING OF DORMANT EGGS OF ACARTIA CALIFORNIENSIS (COPEPODA) IN AN OREGON ESTUARY,
Oregon State Univ., Corvallis. School of Oceanography.
J. K. Johnson.
Fishery Bulletin, Vol 77, No 3, p 567-584, 1979. 11 Fig, 3 Tab, 32 Ref.

Descriptors: *Copepods, *Hatching, *Inhibition, *Dormancy, Water temperature, Salinity, Toxicity, Growth stages, Growth rates, Embryonic growth stage, Mortality, Seasonal, Zooplankton, Oregon, Yaquina Bay, Estuaries, *Acartia.

Experimental results indicate that induction of dormancy in Acartia californiensis eggs is temperature dependent and occurs below 15C in two ways: (1) Cold adapted females spawn true resting eggs which exhibit major differences in hatching and survival rates from nondormant eggs under similar conditions. (2) Nondormant eggs spawned above 15C may become dormant and have short-term viability at temperatures below 15C. Salinity does not induce dormancy. Hatching results of field-collected resting eggs at naturally occurring temperature-salinity combinations demonstrate that termination of dormancy is also primarily temperature dependent. Salinity, however, regulates rate and success of hatching. In addition, heavy naupliar mortality occurs following hatching at low salinities. Substantial hatching must occur in the field over much of the year. Since subsequent survival and population growth depends on the presence of favorable temperature and salinity conditions, nauplii which hatch during the low salinity winter and spring months in Yaquina Bay must be lost. This phenomenon is viewed as a 'leaky' population diapause. Resting eggs were also demonstrated for Epilabidocera longipedata and Eurytemora affinis, an occurrence previously undescribed in the literature. (Deal-EIS)
W80-03700

EFFECTS OF DAMS AND IMPOUNDMENTS ON MIGRATIONS OF JUVENILE CHINOOK SALMON AND STEELHEAD FROM THE SNAKE RIVER, 1966 TO 1975,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. L. Raymond.
Transactions of the American Fisheries Society, Vol 108, p 505-529, 1979. 7 Fig, 13 Tab, 23 Ref.

Descriptors: *Fish migrations, *Fish barriers, *Columbia River, Chinook salmon, Rainbow trout, Dams, Impoundments, Juvenile growth stage, Mortality, Entrainment, Fish populations, Rivers, Flow rates, Steelhead trout, Pacific salmon, *Snake River.

Migrations of juvenile chinook salmon, Oncorhynchus tshawytscha, and steelhead, Salmo gairdneri, from tributaries of the Snake River were monitored as far downstream as The Dalles Dam on the Columbia River in most years during the period 1966 to 1975. New dams constructed on the Snake River adversely affected survival and delayed migrations of juveniles. Significant losses of juveniles in 1972 and 1973 were directly responsible for record-low returns of adults to the Snake River in 1974 and 1975. Major causes of mortality were passage through turbines at dams, predation, and delays in migration through reservoirs in low-flow years, and prolonged exposure to lethal concentrations of dissolved gases caused by spilling at dams during high-flow years. Migrations of juvenile steelhead were generally later than those of chinook salmon and generally coincided with maximum river discharge. Lack of river runoff in 1973 caused a significant number of steelheads to stop migrating and to hold over in reservoirs. Mortality of chinook salmon and steelhead resulting from new dams has differed with respect to area and cause. Magnitude and composition of seaward migration has changed from 3 to 5 million wild fish in the mid-1960's to 8 to 10 million fish of both wild and hatchery origin in the 1970's. (Deal-EIS)
W80-03701

ROTENONE RESISTANCE OF GOLDEN SHINERS FROM A PERIODICALLY RECLAIMED POND,
Connecticut Dept. of Environmental Protection, Middlebury.
R. D. Orciari.
Transactions of the American Fisheries Society, Vol 108, p 641-645, 1979. 1 Tab, 21 Ref.

Descriptors: *Shiners, *Resistance, *Rotenone, Adaptation, Pesticide toxicity, Piscicides, Bioassay, Mortality, Fish physiology, Fish populations, Fish management, Connecticut, Ball Pond, *Noxfish(Trade name).

Golden shiners (Notemigonus crysoleucas) generally reinfested Ball Pond, New Fairfield, Connecticut in greater numbers after each of six successive rotenone reclamations carried out from 1957 to 1974. To determine if Ball Pond golden shiners had developed resistance to rotenone, paired bioassays were completed with golden shiners from Ball Pond and from seven comparison ponds. Based on tolerance rations, Ball Pond golden shiners were 4.0-7.1 times more tolerant of synergized and unsynergized formulations of rotenone than were golden shiners from unreclaimed ponds. Fish from Ball Pond were only 2.4 times more tolerant of synergized rotenone than were only 2.4 times more tolerant of synergized rotenone than were golden shiners from a pond reclaimed once with synergized rotenone in 1974. Golden shiners from comparison ponds also succumbed earlier to the effects of both rotenone formulations than did fish from Ball Pond. These findings suggest that Ball Pond golden shiners developed increased resistance to rotenone through the selective forces of reclamation. (Deal-EIS)
W80-03702

DYNAMICS AND BEHAVIORAL TOXICOLOGY OF AQUA-KLEEN (TRADE NAME) (2,4-D BUTOXYETHANOL ESTER) AS REVEALED BY THE MODIFICATION OF RHEOTROPISM IN RAINBOW TROUT,
Waterloo Univ. (Ontario). Dept. of Biology.
J. J. Dodson, and C. I. Mayfield.
Transactions of the American Fisheries Society, Vol 108, p 632-640, 1979. 7 Fig, 1 Tab, 17 Ref.

Descriptors: *2,4-D, *Pesticide toxicity, *Rainbow trout, *Rheotropism, Fish physiology, Animal metabolism, Pesticide kinetics, Herbicides, Chlorinated hydrocarbon pesticides, Fish behavior, Lethal limit, Pesticide residues, Bioassay, *Aqua-Kleen(Trade Name).

The rheotropic response of rainbow trout (Salmo gairdneri) to a water current, simulated by a striped background moving past the fish, was observed following 24-hour exposures to field application concentrations of the aquatic herbicide 2,4-dichlorophenoxyacetic acid (2,4-D) butoxyethanol ester and its commercial formulation Aqua-Kleen (Trade Name). Toxicological modification of rhotropism occurred that would in nature lead to an increased incidence of downstream movement. With increasing concentrations of Aqua-Kleen, the rheotropic response became more variable. As concentrations approached lethal levels, rainbow trout became extremely lethargic and could not avoid capture. Aqua-Kleen was lethal to rainbow trout at concentrations approximately twice the suggested field application level. The ester was taken up rapidly by fish and hydrolyzed to 2,4-D that was secreted back into the water. (Deal-EIS)
W80-03703

THE INFLUENCE OF ACCLIMATION TEMPERATURE ON THE INTERACTIONS OF CHLORINE, ELEVATED TEMPERATURE, AND EXPOSURE DURATION FOR GRASS SHRIMP, PALAEMONETES PUGIO,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
L. W. Hall, Jr., D. T. Burton, and S. L. Margrey.
Transactions of the American Fisheries Society, Vol 108, p 626-631, 1979. 4 Fig, 3 Tab, 25 Ref.

Descriptors: *Water temperature, *Chlorine, *Adaptation, *Shrimp, Chlorination, Heated water, Thermal stress, Powerplants, Toxicity, Mortality, Bioassay, Mathematical models, Animal physiology, *Acclimation.

The effect of 15 and 27C acclimation temperatures on interactions of chlorine, elevated temperature (Delta T), and exposure duration was assessed for the grass shrimp. Test organisms were exposed to total residual chlorine (TRC) concentrations of 0.00, 0.15, and 0.30 mg/liter in combination with Delta T's of 2, 6, and 10C above acclimation temperature and exposure periods of 0.08, 2.0 and 4.0 hours. Chlorine concentrations were decayed over a 1 - 1.5-hour period to D0.01 mg/liter TRC and temperatures were decayed over a 4-hour period to 2C above acclimation. Mortality observations were conducted for 96 hours; however, most of the deaths occurred 36 hours after exposure to the three test variables. A percent mortality model for grass shrimp acclimated to 27C showed (1) the response to chlorine concentration alone and Delta T alone was proportional to the square root of either variable; (2) the exposure duration effect was linear; and (3) no second-order interactions occurred among the variables tested. The model for grass shrimp acclimated to 15C showed (1) Delta T had no effect; (2) the response to chlorine concentration was the dominant factor; and (3) there existed a two-way linear interaction between chlorine concentration and exposure duration. (Deal-EIS)
W80-03704

SEMICONTINUOUS OUTDOOR CULTIVATION OF SCENEDESMUS ACUTUS IN WASTE WATER,
Ceskoslovenska Akademie Ved, Trebon. Inst. of Microbiology.
K. Livansky, K. Veber, and B. Prokes.
Acta Hydrochimica et Hydrobiologica, Vol 7, No 4, p 369-378, 1979. 6 Fig, 6 Tab, 8 Ref.

Descriptors: *Scenedesmus, *Waste water treatment, *Microbial degradation, Chlorophyta, Aquatic algae, Sewage treatment, Farm wastes, Domestic wastes, Productivity, Biomass, Nutrients, Phosphorus, Nitrogen, Growth rates, Aquiculture.

The algae were cultivated in an outdoor cultivation unit in waste water from a sewage treatment plant processing city sewage and largescale hoggery effluent. The cultivation area (2 sq m) had a slant of 3% and the suspension layer thickness was about 5 cm. The total suspension volume in the cultivation device was 150 l. Mass balance served us for derivation of formulas for the average rate of algal biomass production and for the extent of nutrient removal from waste water. Experiments showed a considerable effect of dilution rate on individual parameters in these formulas. The removal of nitrogen and phosphorus is optimal at a dilution rate of 0.3/day whereas optimum biomass production lies at about 0.1/day. The nitrogen and phosphorus yield coefficient Y (g biomass/g element) are practically identical, both of them depending on dilution rate. The effect of the dilution rate on other characteristics of the effluent water has not yet been unambiguously proved. The results of bacteriological and mycological examinations and of the chemical analysis of resulting algal biomass are presented. (Deal-EIS)

W80-03705

STUDIES ON THE EFFECTS OF ACIDIC MEDIUM ON THE FRY OF CYPRINUS CARPIO,
Holkar Science Coll., Indore (India). Dept. of Zoology.
R. S. Shrivastava, and P. Dwivedi.
Acta Hydrochimica et hydrobiologica, Vol 7, No 4, p 421-430, 1979. 6 Fig, 1 Tab, 20 Ref.

Descriptors: *Acids, *Toxicity, *Fry, *Carp, Fish eggs, Growth stages, Animal growth, Hatching, Cytological studies, Biological membranes, Mode of action, Bioassay, Lethal limit, Chemical wastes, Industrial wastes, Hydrochloric acid, *Teratogens.

The effects of acidic medium on the fry of Cyprinus carpio have been studied. The eggs were put in various concentrations of HCl ranging from 0.0025 ppm to 0.0500 ppm. One specimen from each experimental group was sacrificed for histological studies every week. It was found that when the fry were kept in the acidic medium the following changes took place. The nucleus became inconspicuous and the cell wall became disorganised. The muscle layers of gut wall became indistinct and disorganised to some extent. The epithelial lining of the gut was partially destroyed. Vacuolation in the connective tissue of gut was seen due to destruction of some of the cells. Hepatic cells of the liver were destroyed at various spots to a varying degree. A comparative study of results showed that the percentage of hatching is inversely proportional to the strength of pollutant (HCl). The LD-50 period of fry is inversely related to the strength of HCl in ppm. (Deal-EIS)
W80-03706

MUTAGENICITY OF FLUORENE DERIVATIVES: A PROPOSED MECHANISM,
Massachusetts Univ., Amherst. Dept. of Botany.
D. E. Levin, W. S. Barnes, and E. Klekowski.
Mutation Research Vol 63; p 1-10 1979. 3 Fig, 2 Tab, 27 Ref. OWRT B-053-MASS (6).

Descriptors: *Mutagens, *Fluorene derivatives, *Salmonella, Water pollution, Pollutant identification.

Several derivatives of fluorene, a tricyclic, organic molecule, have been found to induce both frameshift mutations and base-pair substitutions in Salmonella typhimurium strains developed by Ames. Comparisons of the mutagenic potency of these derivatives for several strains of Salmonella suggest the importance of a carbonyl group substituted at the carbon-9 position of mutagenic derivatives, with respect to mutagenic potency. In this study, a feasible mechanism for the interaction of mutagenic fluorene derivatives with deoxyribonucleic acid is presented. This mechanism requres the interaction of the mutagenic molecule with carbon-8 of guanine and a second concurrent interaction with the C-4 amino group of an adjacent cytosine residue. (Godfrey-Mass)
W80-03745

MUTAGENS IN A RIVER HEAVILY POLLUTED WITH PAPER RECYCLING WASTES: RESULTS OF FIELD AND LABORATORY MUTAGEN ASSAYS,
Massachusetts Univ., Amherst. Dept. of Botany.
E. Klekowski, and D. E. Levin.
Environmental Mutagenesis Vol 1; p 209-219, 1979. 3 Tab, 19 Ref. OWRT B-053-MASS (7).

Descriptors: *Paper recycling, *Mutagens, *Water pollution, *Industrial wastes, *Pulp and paper industry, Environmental effects, Biota, Ecotypes, Pollutant identification.

A natural population of the fern Osmunda regalis growing in a river heavily polluted with paper recycling wastes had a high incidence of chromosome mutations. This population was monitored for four years for the frequency of two-break chromosome mutations. These mutations were postzygotic in origin and suggested the presence of mutagens in the river water. The fern population is downstream from the outfalls of a paper recycling mill, which was discharging 13.3 X 10 to the 6th power liters of untreated paper recycling waste per day. In 1977 a waste-water-treatment facility was constructed to remove the solid waste previously discharged into the river. This facility generates 69,300 kg of solid waste daily, which is taken to a landfill. Periodic samples of this solid waste were collected from the waste-treatment facility in the summer of 1978, extracted with various solvents, and the extracts tested for mutagenic activity with the Salmonella/mammalian microsome mutagenicity test (Ames et al, 1975). A majority of the solid waste samples contained mutagenic materials, but in all cases S-9 activation was required for mutagenic activity. The samples also were assayed with the soybean mitotic crossing-over assay (Vig, 1975). Four out of six samples were positive. These results document the presence of mutagens in the solids waste generated by a paper recycling industry and the genetic impact of these mutagens on the local biota. (Godfrey-Mass)
W80-03746

AN EMPIRICAL MODEL FOR PHYSICAL PARAMETERS OF RECENT SEDIMENTARY DEPOSITS OF LAKE EKOLN AND LAKE VANERN,
National Swedish Protection Board, Uppsala.
L. Hakanson.
Vatten, Vol 33, No 3, p 266-289, 1977. 27 Fig, 5 Tab, 33 Ref.

Descriptors: *Sediments, *Sedimentation, *Lake Ekoln, Sweden, *Interstitial water, *Lake Vanern, Sweden, Organic matter, Density, Depth, Particle size, Fetch, Equations, Erosion, Erosion rates, Lake beds, Curves, Correlation analysis, Compaction, Sedimentation rates.

In Lakes Ekoln and Vanern, Sweden, the internal physical sediment status of the biologically active sediment layer, indicated by water content, organic content, bulk density, inorganic matter density, grain size, sediment compaction and sediment depth, can be described by general empirical equations. Furthermore, the model shows that water content correlates with all internal variables. Internal sediment status also correlates with external governing parameters such as effective fetch, water depth, slope and distance from river mouth. This indicates that the bottom dynamic situation may be determined before sediment samples have been collected. This approach makes it possible to predict areal distribution of erosion, transportation and accumulation zones. Sediment samples must be collected to establish the physical status of accumulation bottom sediments. After empirical constants are determined, the gross variation of all internal sediment parameters throughout the active layer within accumulation zones may be calculated. Lakes Ekoln and Vanern differ significantly in terms of size, trophic status, bottom fauna and alloctonous influence. Lake Ekoln has 19 sq km area, 38.3 m maximum depth and is eutrophic. Lake Vanern has 5,650 sq km area, 106 m maximum depth and is oligotrophic. Work focuses on biologically active deposits within accumulation zones. (Danovich-Wisconsin)
W80-03790

VERY SIMPLE MODEL OF THE INITIAL STAGE OF OLIGOTROPHIC-EUTROPHIC SUCCESSION. IN BODIES OF WATER,
Moscow State Univ., (USSR).
V. V. Alekseev, and M. S. Polyakova.
The Soviet Journal of Ecology, Vol 9, No 1, p 1-5, January-February, 1978, 2 Fig, 5 Ref. Translated from Ekologiya, No 1, p 5-10, January-February, 1978.

Descriptors: *Succession, *Mathematical models, *Ecosystems, *Speication, Eutrophication, Oligotrophy, Biological communities, Biomass, Nutrients, Nitrogen, Phosphorus, Equations, Kinetics, Nutrient loading, Trophic level, Invasion, Food abundance, Food chains, Foods, Competition.

A succession process model in oligotrophic water bodies shows that increasing total mass of system-limiting biogenic elements increases the number of species. However, the maximal number of species in the climatic community differs; it is maximal when consumers are mainly specialized for a particular diet. If the character of trophic connections between species is known, matter circulation schemes can be compiled in certain limiting ecosystems containing all these species. Ecosystems biomass increase rates are determined by biogenic elements present in the ecologic minimum. In water ecosystems these biogenic elements are usually nitrogen or phosphorus. Dynamic model variables are ecosystem component masses such as species biomass. The model consists of differential equations describing ecosystem kinetics. It can predict tendencies taking place during natural or artificial species introduction. On introduction, one specie may be supplanted by another. Adaptation to abiotic environmental factors is exceptionally important for the immigrant species survival; however, the immigrant's biotic environment, principally food reserves and enemies, are also important to attain high abundance. The model predicts a given species ability to survive approximately, if trophic system connections between species and quantitative estimates of these connections are known. (Danovich-Wisconsin)
W80-03792

THE DISTRIBUTION OF ALGAL EPIPHYTES ON MACROPHYTE HOSTS OFFSHORE FROM LA PARGUERA, PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Marine Sciences.
For primary bibliographic entry see Field 5C.
W80-03797

BODY SIZE AND FEEDING ECOLOGY AS ALTERNATIVES TO TAXONOMY FOR THE STUDY OF LIMNETIC ZOOPLANKTON COMMUNITY STRUCTURE,
Erindale Coll., (Ontario). Dept. of Zoology.
W. G. Sprules, and L. B. Holtby.
Journal of the Fisheries Research Board of Canada, Vol 36, No 11, p 1354-1363, November 1979. 1 Fig, 7 Tab, 51 Ref.

Descriptors: *Zooplankton, *Systematics, *Biological communities, *Size, *Food habits, *Ecotypes, Lakes, Bruce Peninsula, Ontario, Energy, Energy transfer, Food webs, Ecology, Ecosystems, Regression analysis, Correlation analysis, Dominant organisms, Food chains, Southeast Asia, Sri Lanka, Tropical regions, Canada.

Analysis of methods for characterizing limnetic zooplankton community structure in 44 water bodies of Bruce Peninsula, Ontario July and August 1975 show that in comparison with taxonomy, ecological and image analysis characterization reflect zooplankton community features better in terms of efficiency and energy flow. While patterns in taxonomic community structure are of interest, characterizations of zooplankton associations on the basis of body size and feeding ecology are of greater use because (1) they more closely reflect zooplankton community features which are related to efficiency and energy flow through pelagic ecosystems; (2) emphasis of simpler, more ecologically significant size characteristics results in stronger relations to lake limnological features; (3) they provide more informative comparisons of plankton communities from disparate zoogeographic regions; and (4) they require less money, expertise and time in community data acquisition. Excepting major equipment capital costs and presuming access to an image analyzer, individual sample processing time for image analysis is 25% that for ecological analysis which is 33% that for taxonomic analysis. Furthermore, body size-feeding ecology analysis or image analysis zooplankton associations more strongly correlate statistically to lake morphometric and hydrological properties. Body size-feeding ecology characterizations also provide more useful functional insights than taxonomically based ones when comparing zooplankton communities from Bruce Peninsula, Ontario and southeast Asia, particularly Sri Lanka. (Danovich-Wisconsin)
W80-03815

ASSESSMENT OF AQUATIC WEED PROBLEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
For primary bibliographic entry see Field 4A.
W80-03826

TAXONOMIC CHARACTERISTICS OF AQUATIC PLANTS FROM THE ALIMENTARY TRACT OF GRASS CARP,
Florida State Game and Fresh Water Fish Commission, Eustis. Eustis Fisheries Research Lab.
For primary bibliographic entry see Field 4A.
W80-03831

5B. Sources Of Pollution

ENTEROVIRUS INACTIVATION IN SOIL AND STRUCTURAL CHANGES ASSOCIATED WITH THE INACTIVATION OF SOIL-BOUND VIRUSES,
New Mexico State Univ., Las Cruces. Dept. of Biology.
For primary bibliographic entry see Field 3C.
W80-03603

RIVER-QUALITY ASSESSMENTS.
Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. American Water Resources Association, St Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota, 1978. 190 p, Greeson, P.E., Editor.

Descriptors: *Water quality, *River basins, *Conferences, *Oregon, *Georgia, *Colorado, *Wyoming, *On-site investigations, Water resources, Water pollution, Water management(Applied), Water quality control, Low-flow augmentation, Water treatment, Water pollution sources, Erosion, Water properties, Dissolved oxygen, Biochemical oxygen demand, Thermal water, Model studies, Rivers, Watersheds(Basins), *Willamette River Basin(OR), *Chattahoochee River Basin(GA), *Yampa River Basin(CO), Secondary treatment, River-quality assessments, Pilot studies.

River-quality assessments were made during pilot studies on the Willamette River basin in Oregon, the Chattahoochee River basin in Georgia, and the Yampa River basin in Colorado and Wyoming. The ten papers presented at the symposium reported on these pilot studies in the broad subject areas of Concepts of River-Quality Assessments and Selected Methods for Addressing River-Quality Problems. (See W80-03607 thru W80-03616) (Humphreys-ISWS)
W80-03606

RIVER-QUALITY ASSESSMENT: CONCEPT, FRAMEWORK, AND APPLICATION IN THE WILLAMETTE RIVER BASIN, OREGON,
Geological Survey, Portland, OR.
For primary bibliographic entry see Field 6B.
W80-03608

AN INTERIM REPORT ON THE INTENSIVE RIVER-QUALITY ASSESSMENT OF THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA.
R. N. Cherry, R. E. Faye, J. K. Stamer, and R. L. Kleckner.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 22-42, 1978. 15 Fig, 4 Tab, 2 Ref.

Descriptors: *Water quality, *River basins, *Georgia, *On-site investigations, Water pollution sources, Urbanization, Pollutants, Water pollution, River regulation, Data collections, Biological communities, Water utilization, Dissolved solids, Dissolved oxygen, Water temperature, Phytoplankton, Algae, Sediments, Discharge(Water), Land use, Thermal water, Water supply, Hydroelectric power, Hydrology, *Chattahoochee River Basin(GA), River-quality assessment.

The purpose of this report was to present a general description of the area, present and future water uses in the basin, and findings of the study relating to water-quality problems. Urbanization and hydropower releases have a pronounced effect on the quality of the waters of the Chattahoochee River. Loads of total and dissolved constituents increase exponentially with increases in urbanization within the basin. Urban point and nonpoint waste sources contribute most of the dissolved solids and large amounts of the suspended loads to the river. Annually, point sources contribute about 53% of the total phosphorus and 47% of the total nitrogen loads determined at a station 30 miles downstream of Atlanta. Nonpoint sources contributed 78% of the dissolved solids and 72 to 89% of the heavy metal load. Point source discharges of carbonaceous and nitrogenous loads contribute about equally to low dissolved oxygen concentrations (4.6 mg/l) in the river during low flow. Heat loads from thermoelectric generating facilities increase the rate at which the dissolved oxygen in the river is depleted. Hydropower releases and regulation of flows from Buford Dam and Morgan Falls reduce the frequency and magnitude of high and low flows of the river. During low flow periods the net effect of the regulated flow is to cool the waters of the Chattahoochee River and dilute the waste discharges from urban areas. Sediment yields in the basin are primarily a function of drainage area, rainfall, and land use. (See also W80-03606) (Humphreys-ISWS)
W80-03609

TOWARD A CONCEPTUAL FRAMEWORK FOR RIVER-QUALITY TREND AND CAUSE-EFFECT ANALYSIS,
URS Co., Seattle, WA.
W. G. Hines, and D. A. Rickert.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 65-72, 1978. 2 Fig, 1 Tab, 7 Ref.

Descriptors: *Water quality, *Monitoring, *Rivers, *Hydrologic aspects, Water pollution, Planning, Management, Analysis, Streamflow, Water temperature, Channel morphology, Salinity, Toxicity, Algae, Dissolved oxygen, Water sampling, Analytical techniques, Methodology.

River-quality planning and management programs have been hampered by a general inability to analyze and document pollution trends and cause-effect relations. River-quality data programs historically have been based on routine monitoring approaches that provide poor capability for separating those quality variations caused by the natural hydrologic regimen from those caused by pollution loads. An outline for a new conceptual framework was proposed as a basis for improving the interpretive utility of river-quality data programs. The framework is based on (1) a hydrologic analysis focusing on streamflow and water temperature patterns and channel morphology characteristics, (2) the use of a multiple steady-state concept to 'keep track' of seasonal quality variations and to provide a guide for the timing of (3) intensive, synoptic sampling studies (in lieu of routine monitoring) made during the most critical times and pollution-prone river reaches. Viewed from the broadest perspective, a commitment to the program outlined would involve a shift to a flexible, opportunistic approach, and away from a rigidly structured routine approach. Importantly, however, the results from many different river systems would be bound by the common conceptual framework offered by the consideration of river hydrology and its intimate relation to the temporal and spatial form of each river-quality process and problem. (See also W80-03606) (Humphreys-ISWS)
W80-03611

DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND,
Cook Coll., New Brunswick, NJ. Dept. of Environmental Science.
For primary bibliographic entry see Field 5A.
W80-03612

ALGAL GROWTH POTENTIAL--LOWER WILLAMETTE RIVER, OREGON,
Portland State Univ., OR. Dept. of Biology.
R. Petersen.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 101-124, 1978. 14 Fig, 1 Tab, 36 Ref.

Descriptors: *Water quality, *Aquatic life, *Rivers, *Oregon, Ecosystems, On-site investigation, On-site data collections, Aquatic environment, Phytoplankton, Nutrients, Diatoms, Plankton, Primary productivity, Silica, Nitrates, Nitrogen, Phosphorus, Water sampling, Laboratory tests, Spatial distribution, Temporal distribution, Dissolved oxygen, Algae, *Willamette River(OR).

The growth of planktonic algae was investigated in the lower reaches of the Willamette River during 1973 and 1974. Primary productivity was not high, and the dominant species observed were diatoms. Orthophosphate, silica, and nitrate plus ammonia were present in concentrations well above levels that are considered limiting to algal growth. High inorganic turbidity and a relatively deep mixed layer evidently limited algal growth in the lower reaches of the Willamette River. (See also W80-03606) (Humphreys-ISWS).
W80-03614

THERMAL MODELING OF HIGHLY TRANSIENT FLOWS IN THE CHATTAHOOCHEE RIVER NEAR ATLANTA, GEORGIA,
Geological Survey, NSTL Station, MS.
For primary bibliographic entry see Field 2E.
W80-03615

TRACE ELEMENT LOADING OF SOUTHERN LAKE MICHIGAN BY DRY DEPOSITION OF ATMOSPHERIC AEROSOL,
Governors State Univ., Park Forest South, IL. Coll. of Environmental and Applied Sciences.
D. A. Dolske, and H. Sievering.
Water, Air, and Soil Pollution, Vol 12, No 4, p 485-502, November 1979. 2 Fig, 9 Tab, 29 Ref. EPA R00530101.

Descriptors: *Trace elements, *Lake Michigan, *Aerosols, *Water pollution sources, Metals, Chemicals, Sampling, Monitoring, Chemical analysis, Air pollution, Water pollution, Winds, Air temperature, Water temperature, Currents(Water), Pollutants, Path of pollutants.

Aerosol samples and meteorological data were collected at a mid-southern Lake Michigan site (87 deg 00 min W, 42 deg 00 min N) from May through September 1977. Hi-volume samplers with cellulose fiber filters and a digital meteorological data recording system were operated on board the U.S. EPA's R/V Roger R. Simons during four intensive sampling periods. Aerosol samples were analyzed by atomic absorption spectroscopy for seventeen trace elements. A diabatic drag coefficient method was used to determine aerosol deposition velocity (nu sub d) overlake. A mean nu sub d of 0.5 cm/s was found for the aerosol diameters between 0.1 and 2.0 micrometers. By relating the observed trace element concentrations and nu sub d to a long-term climatological record, annual dry deposition loadings to the southern basin for nine elements were estimated. For four elements, Fe, Mn, Pb, and Zn, dry deposition loadings to the southern basin alone of at least 500000, 30000, 250000, and 100000 kg/yr were found. For Fe and Mn, these loadings represent about 15% of the total of all inputs to Lake Michigan. For Zn and Pb, about one-third to one-half of the annual loading from all sources is from dry deposition of atmospheric aerosol. (Sims-ISWS)
W80-03621

ON THE VALUE OF SOIL COLUMNS FOR ASSESSING THE TRANSPORT PATTERN OF VIRUSES THROUGH SOILS: A CRITICAL OUTLOOK,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
G. Bitton, J. M. Davidson, and S. R. Farrah.
Water, Air, and Soil Pollution, Vol 12, No 4, p

449-457, November 1979. 2 Tab, 30 Ref.

Descriptors: *Soils, *Viruses, *Path of pollutants, *Waste disposal, Effluents, Sewage effluents, Sewage sludge, Pollutants, Water pollution, Soil contamination, Soil water, Groundwater, Soil water movement, Laboratory tests, On-site investigations, Monitoring, Reviews.

The U.S. Water Pollution Control Act Amendment of 1972 (PL 92-500) has made land disposal of wastewater effluents and residuals a viable and attractive alternative. Land spreading of wastewater effluents and residuals has many advantages, including the addition of plant nutrients, water conservation, improvement of soil physical properties, and increased soil organic matter. Public health risks associated with land disposal of wastes containing human pathogens can be assessed only through a thorough examination of the survival and transport pattern of these pathogens through soils. This topic has been thoroughly covered in recent reviews. In this review, the authors were primarily concerned with a critical examination of the various methods frequently used to assess soils' potential to retain viruses. Knowledge concerning the transport pattern of viruses through soils can be gained through field monitoring of these infectious particles in wastewater effluents, sludges, soils and groundwater, and/or through soil column experiments. The latter have been criticized, and our purpose was to examine these criticisms and suggest, if necessary, some alternate solutions. Furthermore, the authors reviewed the practical information gained through soil column studies and examined, with the aid of examples of land application sites across the country, the relationship between laboratory and field studies. (Sims-ISWS)
W80-03622

INCIDENTS OF ELEVATED NITRATE IN SOUTHERN ONTARIO,
Ontario Ministry of the Environment, Toronto (Ontario).
K. C. Heidorn.
Water, Air, and Soil Pollution, Vol 12, No 4, p 417-429, November 1979. 11 Fig, 2 Tab, 19 Ref.

Descriptors: *Nitrates, *Air pollution, *Path of pollutants, *Canada, *Great Lakes, Water pollution sources, Nutrients, Acids, Nitrogen compounds, Weather, Winds, Meteorology, *Ontario.

A study of nitrate in suspended particulate in the lower Great Lakes region of southern Ontario, Canada, during the period 1976-1977 has indicated that elevated levels (in excess of 9.9 micrograms/cu m) occur simultaneously across the region on certain days. These days most frequently fall within the cold-season months of October to March. The most common weather situation on these days is the presence of an anticyclone over or to the east of southern Ontario. Case studies of three periods in early 1977 during which widespread elevated nitrates occurred showed nitrate levels to be dependent upon the previous history of the air mass. When back trajectories showed that the air mass had previously moved across the lower Great Lakes, nitrate levels were high. Low nitrate levels were most common when the air mass had moved across the upper Great Lakes. The low variability of nitrate concentration among the monitoring network and similar history of air mass movement indicates that long range transport is, in part, responsible for elevated ambient nitrate levels. (Sims-ISWS)
W80-03623

ROLE OF RILL DEVELOPMENT IN SALT LOADING FROM HILLSLOPES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W80-03643

CONTRIBUTIONS OF URBAN LAND USE TO STREAM WATER QUALITY,
Delaware Univ., Newark. Dept. of Civil Engineering.
D. L. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151178, Price codes: A08 in paper copy, A01 in microfiche. MS Thesis, 1979, 139 p, 80 Ref. OWRT B-018-DEL(2), 14-34-0001-8070.

Descriptors: *Urban runoff, *Path of pollutants, *Lead, Cadmium, Streams, Inflow, Surface runoff, Storm water, Delaware, *Christiana River(Del).

The impact of urban runoff on stream water quality with respect to cadmium and lead in both the particulate and liquid phase, was examined for the Christiana River in the Newark, Delaware area. Five stations were selected, each depicting a different degree of urbanization. Measured concentrations were correlated with stream volumetric flow rates so that storm discharge values could be calculated. Four complete storm events were sampled at appropriate time intervals with results indicating that lead pollution originated from surface stormwater runoff. Rainwater pH demonstrated a temporal variation within a storm event such that increasing pH during a storm controlled the liquid or solid phase concentrations of lead, but cadmium concentrations did not appear to exceed any possible solubility of pH-controlled precipitates. Stream sediment examination indicated primarily that lead was associated with the sediment solids while cadmium remained soluble. Analysis of stream sediments and soils at the sampling stations indicated that these solids, suspended during storm events possess significant adsorption capacity. Modeling efforts with the resulting data indicate the hydraulic dispersion and stochastic models were most appropriate for describing the stream response to storm events.
W80-03644

EFFECT OF SOME CHEMICAL AGENTS ON THE UPTAKE OF 32P AND 65ZN BY MACROPHYTES IN THE BLACK SEA,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
L. I. Rozhanskaya, I. V. Demina, and A. V. Parkhomenko.
Hydrobiological Journal, Vol 14, No 3, p 74-76, 1978. 2 Fig, 10 Ref.

Descriptors: *Absorption, *Algae, *Phosphorus, *Zinc, *Phenols, Zinc radioisotopes, Phosphorus radioisotopes, Tracers, Radiochemical analysis, Path of pollutants, Chemical properties, Phenols, Organic compounds, *Cystoseira, Phenol, Hydroquinone, Fluoroglucin.

Data are presented on the uptake of 32p by the Black Sea alga Cystoseira barbata in the presence of compounds with one (phenol), two (hydroquinone) and three (fluoroglucin) hydroxy groups. Phenol and hydroquinone stimulate the uptake of 32p in sea water. Fluroglucin first inhibits its uptake, then later stimulates it. The uptake of 65Zn in the presence of hydrogen sulfide was likewise inhibited initially, but later facilitated. (Deal-EIS)
W80-03662

THE ABSORPTION OF DDT BY VASCULAR AQUATIC PLANTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
A. I. Merezhko, and T. I. Shokod'ko.
Hydrobiological Journal, Vol 14, No 3, p 68-73, 1978. 4 Fig, 1 Tab, 15 Ref.

Descriptors: *Rooted aquatic plants, *Absorption, *DDT, Pesticide kinetics, Pesticide toxicity, DDD, DDE, Chlorinated hydrocarbon pesticides, Root systems, Plant physiology, Tracers, Radiochemical analysis, Marsh plants, *Bioaccumulation, *Tissue analysis.

Pondweed and reeds absorb and accumulate significant quantities of DDT. The stability of the mechanism by which pondweed absorbs this pesticide--which we can judge by considering changes in the curves which represent the absorption of DDT-14C as a function of concentration and exposure time--enable us to postulate that this plant has no active mechanism for regulating DDT absorption. Its accumulation of the insecticide is governed by the latter's concentration and by the time the plant is exposed to it; absorption continues until it kills the plant. In reeds, an active protective mechanism was found which responds to high concentrations of DDT in the environment. This mechanism takes the form of an accumulation of large quantities of DDT by the root system so that large quantities of DDT do not reach the stems and leaves. Changes in the ratios of DDT, DDD and DDE in the water, roots and leaves indicate that partial dechlorination of the pesticide occurs in growing reeds. This suggests that reeds play a substantial role in the processes by which bodies of water cleanse themselves of DDT residues. (Deal-EIS)
W80-03663

IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS TRANSFERRED TO FISH FROM PETROLEUM SUSPENSION BY MASS CHROMATOGRAPHY,
Okayama Univ. (Japan). Dept. of Public Hygiene.
M. Ogata, and Y. Miyake.
Water Research, Vol 13, p 1179-1185, 1979. 4 Fig, 1 Tab, 7 Ref.

Descriptors: *Pollutant identification, *Oil pollution, *Eels, Sulfur compounds, Chemical analysis, Oil, Gas chromatography, Mass spectrometry, Organic compounds, Path of pollutants, Chemical properties, Monitoring, *Tissue analysis, *Crude oil, *Naphthalenes, *Benzothiophenes, *Dibenzothiophenes.

The authors attempted to select organic sulfur compounds usually contained in crude oil as markers of oil pollution in fish. To confirm this, eels (Anguilla japonica) were maintained in a controlled laboratory environment in water with suspensions of crude oil. Gas chromatography-mass spectrometry and mass chromatography of eel flesh extract showed the presence of organic sulfur compounds of alkyl-(from mono- to pentamethyl) benzothiophenes, dibenzothiophene and alkyl-(from mono- to trimethyl) dibenzothiophene and of other organic sulfur compounds of alkyl-(from mono- to pentamethyl) naphthalene. Alkyl benzothiophenes or alkyl dibenzothiophenes of lower carbon numbers were more easily transferred to eel than those of higher carbon numbers. (Deal-EIS)
W80-03671

QUANTITATIVE EXTRACTION OF CHLORINATED ORGANIC PESTICIDES AND POLYCHLORINATED BIPHENYLS FROM FISH ORGANS AND TISSUES,
Institute of Experimental Meteorology Obrinsk (USSR).
For primary bibliographic entry see Field 5A.
W80-03674

EXTRACTION AND ACCUMULATION OF 210PB BY AQUATIC ORGANISMS IN LAKES,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
R. F. Dusauskene-Duz, and G. G. Polikarpov.
Hydrobiological Journal, Vol 14, No 3, p 62-67, 1978. 1 Fig, 7 Tab, 17 Ref.

Descriptors: *Lead radioisotopes, *Absorption, *Aquatic algae, *Aquatic plants, Lead, Heavy metals, Radioecology, Radiochemical analysis, Tracers, Lakes, Plant physiology, Metabolism, Path of pollutants, *Tissue analysis, *Bioaccumulation, *Chara, Potamogeton.

Studies of four lakes with different natural thermal profiles showed that the concentration of Pb-210 in the water is independent of depth, and averages 0.26 picocuries per liter. Algae accumulate Pb-210 more actively and in larger amounts than do macrophytes. The accumulation coefficients (AC) are 650 and 300, respectively. The alga with the highest AC (1600) for this radioisotope is Chara contraria. Among macrophytes the highest AC (430) is found in a group of Potamogetonaceae. Extraction of 210Pb from water depends on the plants' absorption capacity and biomass. (Deal-EIS)

W80-03677

IMPACT OF NUTRIENT ENRICHMENT IN A WATERCHESTNUT ECOSYSTEM AT TAKAHAMA-IRI BAY OF LAKE KASUMIGAURA, JAPAN, II ROLE OF WATERCHESTNUT IN PRIMARY PRODUCTIVITY AND NUTRIENT UPTAKE,
Tsukuba Univ., Sakuramura Ibaraki (Japan). Inst. of Biological Sciences.
T. Tsuchiya, and H. Iwaki.
Water, Air, and Soil Pollution, Vol 12, p 503-510, 1979. 3 Fig, 1 Tab, 10 Ref.

Descriptors: *Plant physiology, *Nutrients, *Photosynthesis, Primary productivity, Trophic level, Eutrophication, Lakes, Aquatic plants, Rooted aquatic plants, Root systems, Growth rates, Inhibition, Cyanophyta, Metabolism, *Waterchestnut, *Trapa.

Waterchestnut was shown to be one of the most efficient agents to yield photosynthetic products among aquatic plants in littoral vegetation. Though the plant can be an agent to remove nutrients in agricultural and domestic wastes directly through its waterroots to some extent, waterchestnut plays a great role in removing nutrients through its roots from lake sediments to water-column of the lake. Waterchestnut can be choked to death when its leaves are covered completely by the heavy blue-green algal bloom typical in hypereutrophic lakes. (Deal-EIS)
W80-03681

MERCURY CIRCULATION IN AQUATIC ENVIRONMENT. PART 2: METABOLISM OF METHYL AND PHENYL MERCURY IN PHYTOPLANKTON,
Institut Hygieny a Epidemiologie, Prague (Czechoslovakia).
B. Havlik, J. Stary, J. Prasilova, K. Kratzer, and J. Hanusova.
Acta Hydrochimica et Hydrobiologica, Vol 7, No 4, p 401-408, 1979. 6 Fig, 28 Ref.

Descriptors: *Mercury, *Phytoplankton, *Metabolism, Chlorella, Scenedesmus, Cyanophyta, Aquatic algae, Path of pollutants, Radiochemical analysis, Tracers, Absorption, Radioisotopes, *Biotransformation, *Methylmercury, *Bioaccumulation, Inorganic mercury, Detoxification.

The biotransformation of phenyl and methyl mercury chloride was studied in experiments with planktonic algae Chlorella kessleri, Scenedesmus obliquus and blue-green algae Microcystis incerta. To algal cultures cultivated in an inorganic medium the labelled phenyl or methyl mercury hydroxide was added separately in the phase of the logarithmic growth, the resultant concentration being (3.2 times 10 to the minus 7th power). In intervals of 0, 1, 3, 7, 10 and 14 days samples of the algae and medium were analysed for the total amount of mercury and for the presence of phenyl or methyl mercury. It was found that both methyl and phenyl mercury had accumulated very rapidly in the algae and that up to 70% of 203Hg added was present in the algae during the first 72 hours of the experiment. From the 2nd day onwards, however, methyl and phenyl mercury changed rapidly into inorganic mercury so that by the end of the experiment almost all of the mercury present in algae and the medium was in the form of inorganic mercury. (Deal-EIS)
W80-03682

A REVIEW OF THE LETHAL AND SUBLETHAL EFFECTS OF MERCURY ON AQUATIC LIFE,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Research Lab.
For primary bibliographic entry see Field 5A.
W80-03683

TRANSFER OF 14C-TOLUENE FROM MOSQUITO LARVAE TO BLUEGILL SUNFISH,
Aerospace Medical Research Lab., Wright-Patterson AFB, OH.
W. O. Berry, and J. W. Fisher.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 733-736, 1979. 1 Tab, 6 Ref.

Descriptors: *Food chains, *Path of pollutants, *Sunfishes, *Mosquitoes, Radiochemical analysis, Tracers, Larval growth stage, Fish food organisms, Absorption, Oil, *Toluene, *Bioaccumulation, *Tissue analysis.

Fourth-instar larvae of the mosquito Aedes aegypti were exposed to a toluene-water solution for 3h, then fed to bluegill sunfish under controlled conditions. At selected time periods (1,4,8,24 and 48 hrs) 5 fish were sacrificed and analyzed. With the exception of the stomach and intestine, there was no difference in the concentration of 14C-toluene in the organs of experimental and control fish. The accumulation of toluene in stomach and intestine would be expected as the ingested, toluene-treated larvae pass along the alimentary canal. These results support the contention that bioaccumulation of chemicals within aquatic food chains is insignificant when compared to accumulation directly from water. (Deal-EIS)
W80-03686

MOBILIZATION OF ORGANOCHLORINES FROM FEMALE LIPID TISSUE AND TRANSPLACENTAL TRANSFER TO FETUS IN A HARBOUR PORPOISE (PHOCOENA PHOCOENA) IN A CONTAMINATED AREA,
Nederlands Inst. voor Onderzoek der Zee, Texel.
J. C. Duinker, and M. Th. J. Hillebrand.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 728-732, 1979. 1 Fig, 1 Tab, 21 Ref.

Descriptors: *Pesticide residues, *Pesticide kinetics, *Marine animals, Mammals, Polychlorinated biphenyls, DDT, DDD, DDE, Dieldrin, Chlorinated hydrocarbon pesticides, Path of pollutants, Animal physiology, Animal metabolism, *Marine mammals, *Porpoise, *Tissue analysis, *Bioaccumulation, Harbor porpoise, Netherlands.

The fetus of a harbour porpoise from a female stranded on a beach was analyzed for organochlorine content. The highest concentrations of organochlorines are those of PCBs, DDT and dieldrin. The residue concentrations in the fetus are on the same order as the high values detected in adult specimens found dead along the Dutch coast. The results suggest that a significant fraction of the body burden of organochlorines in the female can be transferred to the fetus. (Deal-EIS)
W80-03687

ORGANOCHLORINE, FLUORINE, AND HEAVY-METAL LEVELS IN SOME BIRDS FROM NEW ZEALAND ESTUARIES,
Department of Agriculture, Wellington (New Zealand). Wallaceville Animal Research Center.
J. C. Turner, S. R. B. Solly, J. C. M. Mol-Krijnen, and V. Shanks.
New Zealand Journal of Science, Vol 21, p 99-102, 1978. 1 Tab, 18 Ref.

Descriptors: *Pesticide residues, *Heavy metals, *Fluorine, *Birds, Estuarine environment, Chlorinated hydrocarbon pesticides, DDT, Polychlorinated biphenyls, Dieldrin, Cadmium, Copper, Lead, Zinc, Mercury, *Arsenic, *Selenium, *Tissue analysis, *Bioaccumulation, *New Zealand.

Five species of birds collected from 7 estuarine areas of New Zealand were analysed for organochlorine residues, fluorine, and heavy metals. There were no significant differences in residue levels between the areas studied other than in that of dieldrin, which was detected only in birds from the Auckland and Christchurch estuaries. There were no significant regional differences in bone fluorine. Pukekos had lower levels of organochlorines than the other species. Species differences for fluorine and for some of the heavy metals were probably related to the type of diet. In general the survey indicated little pollution of the environment, even near the most highly industrialized areas of the country. (Deal-EIS)
W80-03691

THE INFLUENCE OF ADSORPTION ON THE RATES OF MICROBIAL DEGRADATION OF ARSENIC SPECIES IN SEDIMENTS,
Wisconsin Univ.-Madison. Water Chemistry Program.
T. R. Holm, M. A. Anderson, R. R. Stanforth, and D. G. Iverson.
Limnology and Oceanography, Vol 25, No 1, p 23-30, 1980. 6 Fig, 4 Tab, 15 Ref.

Descriptors: *Microbial degradation, *Arsenic compounds, *Mathematical models, Chemical reactions, Biochemistry, Bacteria, Sediments, Chemical properties, Absorption, Precipitation(Chemical), *Biotransformation, *Arsenic.

A model to describe the rates of microbially mediated transformations is presented along with a simple numerical method for kinetic computations in complex systems. The model is tested against the results of arsenic demethylation experiments assuming first-order kinetics and Langmuir adsorption. There is agreement between theory and experiment. (Deal-EIS)
W80-03692

CHEMOTHERAPEUTICAL STUDIES ON TRIMETHOPRIM AGAINST VIBRIOSIS OF POND-CULTURED AYU--II. TISSUE LEVELS AFTER ADMINISTRATION OF TRIMETHOPRIM-SULFADOXINE MIXTURE (IN JAPANESE),
National Research Inst. of Aquaculture (Japan).
H. Sako, R. Kusuda, and T. Tabata.
Fish Pathology, Vol 14, No 2, p 65-70, 1979. 1 Fig, 2 Tab, 7 Ref.

Descriptors: *Chemical properties, *Bactericides, *Fish diseases, Aquiculture, Chemical analysis, Pesticide kinetics, Pesticide residues, Fish physiology, Animal metabolism, *Tissue analysis, *TMP, *Ayu, *Plecoglossus, Trimethoprim, Fish hatcheries.

The present study was designed to investigate the pharmaco-dynamic properties of trimethoprim (TMP) in ayu, Plecoglossus altivelis, after oral administration of TMP-sulfadoxine (SDX) mixture for the control of vibriosis. The results obtained are summarized as follows: (1) Following a single administration of 30 mg of TMP-SDX(1:5) mixture per kg body weight, the highest tissue levels of TMP were obtained 2 hours after medication in the liver at the level of 10.8 mcg/g, 6 hours in the kidney at the level of 4.4 mcg/g, 2/3 hours in the muscle at the level of 1.8 mcg/g, and 1 hour in the blood at the level of 0.4 mcg/ml. (2) Following daily administration of 30 mg of TMP-SDX (1:5) mixture per kg body weight per day for 10 days, TMP level became undetectably low 24 hours after the last medication in the liver, 48 hours in the kidney and the muscle, and 6 hours in the spleen and the blood. (3) It is concluded that TMP is retained in the tissue for some hours, and is excreted almost completely from the fish within a day. Therefore, it is necessary to administer TMP-SDX mixture to ayu more than once a day to maintain constant tissue levels of TMP. (Deal-EIS)
W80-03693

THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 3. A SURVEY OF THE SEWAGE SLUDGE DISPOSAL AREA IN LYME BAY,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Directrorate of Fisheries Research.
For primary bibliographic entry see Field 5A.
W80-03696

DYNAMICS AND BEHAVIORAL TOXICOLOGY OF AQUA-KLEEN (TRADE NAME) (2,4-D BUTOXYETHANOL ESTER) AS REVEALED BY THE MODIFICATION OF RHEOTROPISM IN RAINBOW TROUT,
Waterloo Univ. (Ontario). Dept. of Biology.

For primary bibliographic entry see Field 5A.
W80-03703

SEMICONTINUOUS OUTDOOR CULTIVATION OF SCENEDESMUS ACUTUS IN WASTE WATER,
Ceskoslovenska Akademie Ved, Trebon. Inst. of Microbiology.
For primary bibliographic entry see Field 5A.
W80-03705

METHODS OF ESTIMATING SOME POSSIBLE INTERACTIONS OF AGRICULTURAL DEVELOPMENT AND WATER RESOURCES IN ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 2A.
W80-03711

GEOLOGY AND GEOCHEMISTRY OF ARSENIC, ESTER DOME AREA, ALASKA,
Alaska Univ., Fairbanks. Inst. of Water Resources.
For primary bibliographic entry see Field 2K.
W80-03712

STAGED MULTIPORT DIFFUSERS,
Texas Univ. at Austin. Dept. of Civil Engineering.
C. W. Almquist, and K. D. Stolzenbach.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15185, p 285-302, February 1980. 10 Fig, 3 Tab, 20 Ref, 2 Append.

Descriptors: *Diffusion, *Waste dilution, *Effluents, Thermal pollution, Pollutants, Entrainment, Jets, Mixing, Model studies, Laboratory tests, Mathematical models, Hydraulics, Coastal engineering, *Diffusers, Staged multiport diffusers.

A staged multiport diffuser was schematized as an equivalent line source of momentum, neglecting the effects of effluent volume and buoyancy fluxes. Centerline effluent concentrations inferred from the predicted volumetric dilution induced by the diffuser discharge were in good agreement with values observed in laboratory scale models of staged diffusers. The theory was found to be applicable to the design of staged diffusers in coastal receiving waters. (Sims-ISWS)
W80-03717

INFLUENCE OF A COMPACT ZONE ON SOLUTE TRANSPORT DURING INFILTRATION OF WATER,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.
For primary bibliographic entry see Field 2G.
W80-03727

WATER-QUALITY ASSESSMENT OF THE L'ANGUILLE RIVER BASIN, ARKANSAS,
Geological Survey, Little Rock, AR. Water Resources Div.
C. T. Bryant, E. E. Morris, and J. E. Terry.
Available from: OFSS BX 25425, Fed. Ctr. Denver, CO paper copy $21.75 microfiche $3.50. Geological Survey open-file report 79-1482, 1979. 20 p, 22 Fig, 23 Tab, 45 Ref.

Descriptors: *Water quality, *Streams, *Arkansas, *Streamflow, *Channel morphology, Model studies, Surface-groundwater relationships, Effluents, Water analysis, Chemical properties, Physical properties, Biological communities, Water temperature, Sediment discharge, Nutrients, Pesticides, Dissolved oxygen, Data collections.

For several years, dissolved oxygen in the L'Anguille River has been reduced to concentrations of less than 5.0 milligrams per liter during the summer and fall. In addition, concentrations of pesticides have been reported consistently at one long-term station on the river, and trace metals have been reported at two long-term monitoring sites. The U.S. Geological Survey conducted an intensive study of the L'Anguille River basin during the summer and fall of 1978 in cooperation with the Arkansas Department of Pollution Control and Ecology. An assessment of the general water quality was made; the causes of stream dissolved-oxygen reductions were determined; and the occurrence of pesticides and trace metals in the basin was documented. A steady-state, segmented, dissolved-oxygen model was calibrated and used to project simulated dissolved-oxygen profiles. (Kosco-USGS)
W80-03758

PLACES IN CONNECTICUT WHERE GROUND WATER IS KNOWN TO HAVE DETERIORATED IN QUALITY,
Geological Survey, Hartford, CT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W80-03762

THE INFLUENCE OF URBANIZATION OF THE TRANSPORT OF HEAVY METALS IN NEW JERSEY STREAMS,
Rutgers - The State Univ., New Burnswick, N.J. Dept. of Environmental Science.
W. G. Wilber, and J. V. Hunter.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153570, Price codes: A07 in paper copy, A01 in microfiche. Water Resources Research Institute, Rutgers University, February 1980. Final technical completion report. OWRT A-050-NJ(5), 14-34-0001-8032.

Descriptors: *Heavy metals, *Water pollution sources, Chemical wastes, Sediment distribution, Sediment yield, Precipitation, Lead, Copper, Zinc, Urbanization, Urban runoff, Storm runoff, Water quality, *Saddle River basin(NJ), *Lodi(NJ), Street sweeping.

A study of the transport of heavy metals was performed on a highly developed 4.6-mile stretch of the Saddle River near Lodi, New Jersey. Heavy metal concentrations in stormwater runoff entering the study area varied significantly throughout runoff events and from storm to storm. Lead, zinc and copper contributed from 90 to 98 percent of the total metals measured. Distribution of metals in precipitation samples collected in the study was similar to that in runoff samples, with lead and zinc predominating, although concentrations of metals in rainfall were much lower than those in runoff. Base flow metal concentrations in tributaties to the Saddle River were variable, with highest levels occurring during wet weather. Metal concentrations in Saddle River sediments also varied; the importance of considering bottom scouring of relatively unconsolidated sediments in the transport of metals in river systems was noted.
W80-03774

PHOSPHRUS EXPORT FROM RURAL MAINE WATERSHEDS,
Maine Univ. at Farmington. Center fro Environmental Research and Education.
D. C. Schroeder.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153208, Price codes: A03 in paper copy, A01 in microfiche. Land and Resources Center, University of Maine, Orono. Completion Report, December 1979. 46 p, 13 Tab, 6 Fig, 19 Ref, 1 Append.

Descriptors: *Phosphorus, *Maine, *Eutrophication, *Watersheds(Basins), Land use, Nutrients, Lake stages, Surface waters, Aquatic algae, Mathematical models, Hydrology, Seepage, Sediments, Runoff, Non-point sources.

Methods to quantify non-point source contributions of phosphorus from selected watersheds in Maine are examined. Direct measurement approaches to measure stream phosphorus delivery include factors for phosphorus concentrations and discharge both of which vary with time. Direct approaches described are simulatneous measurement, vojume interval measurement, and typical concentration, all of which are weak because they do not provide for the effects of unusual or changing hydrologic conditions. Also these methods do not consider atmospheric fallout and underground seepage. Indirect estimate methods described are land use, soil erosion, and loading by non-stream sources. All of the methods discussed are summarized in a table giving the situations to which they apply, the information they provide, and limitations. In selecting a method for a particular case a user must consider land use, phosphorus forms, source identification, resources, and accuracy. The methods described were tested over a two year period on four drainage basins and their streams in Maine. Conclusions include: (1) stream total phosphorus (TP) is not directly related to discharge but does depend on flow conditions; (2) wading livestock, logging, or construction can cause higher TP concentrations; (3) eroding soil was not a major source of phosphorus; (4) in a normal year an undisturbed basin exported about 0.19kg TP/ha; and (5) TP export control should be aimed at avoiding disturbances in the watershed. Two methods for estimating non-point source phosphorus loads are recommended. (Seigler-IPA)
W80-03776

FLOW IN THE SEA OF HEAVY METALS FROM A SMELTER INDUSTRY,
T. Hellstrom.
Publication No B 518, Swedish Water and Air Pollution Research Institute, Stockholm, October, 1979. 133 p, 51 Fig, 34 Tab.

Descriptors: *Skellefte Bay, Sweden, *Mineral industry, *Heavy metals, *Distribution, *Mathematical models, *Waste water(Pollution), Gulf of Bothnia, Metals, Copper, Lead, Cadmium, Sedimentation, Discharge(Water), Water pollution, Wastes, Ronnskar, Sweden, Leaching, Sediments, Settling velocity, Flocculation, Currents(Water), Sea water.

A mathematical model indicates that one-third of the heavy metals discharged into Skellefte Bay, Sweden, from the Ronnskarsverken smelter industry are leaving the Bay; however, less than 10% of the metals are leaving the total modeled area and flowing into the Gulf of Bothnia. Ronnskarsverken smelter industry in northern Sweden produces copper, lead, zinc, cadmium, gold, silver, selenium and sulfuric acid. This report deals with lead, copper and cadmium in ionic form and total concentrations and their transport from Skellefte Bay to 100 m depth into the Gulf of Bothnia. Atmospheric emissions for lead, copper, and cadmium are 20, 19 and 0.7 tons/mo, respectively, and sea waste water discharges are 1.0, 1.5 and 0.25 ton/mo, respectively. From the Skellefte River, lead, copper and cadmium discharges are 1.5, 2 and 0.04 ton/mo, respectively, originating from mining activities in the catchment area. A metal flow model was developed to predict metal concentrations and sedimentation rates. The model divides the area into 62 surface and bottom boxes. Each box is completely mixed and works as a combined flocculation and sedimentation tank. Processes modeled include current patterns, flocculation, settling and sediment leaching. Half of Skellefte Bay contains metal concentrations considerably higher than background levels. Even though sediment metal concentrations are high, sediment leaching rates are almost negligible in order to explain the free water concentrations. (Danovich-Wisconsin)
W80-03788

CHARACTERISTICS OF EFFLUENTS FROM GRAY AND BLACK WATER SEPTIC TANKS,
Ontario Ministry of the Environment, Ottawa.
M. Brandes.
Journal Water Pollution Control Federation, Vol 50, No 11, p 2547-2559, November 1978. 3 Fig, 6 Tab, 30 Ref.

Descriptors: *Effluents, *Ontario, Canada, *Septic tanks, *Domestic wastes, *Separated sewers, Sludge, Sewage, Phosphorus, Nitrogen, Coliforms, Water quality, Water pollution, Sewage disposal, Waste disposal, Sewage bacteria, Chemical analysis, Detergents, Decomposing organic matter, Excrement.

This project studies chemical and bacteriological effluent characteristics from an Ontario household septic tank where gray water is treated, compared

to effluent from another septic tank at the same house used only for black (toilet) wastewater treatment. Gray water includes discharge from the kitchen sink, tub and shower, bathroom lavatory, dishwasher, and clothes washing machine. Using separate systems extends detention time in the toilet septic tank. Where normal phosphorus containing detergents are used, total and soluble phosphorus in gray water tank effluent is 7.8 and 0.24 mg/l respectively, compared with 1.4 and 0.17 mg/l, respectively, for phosphorus-free detergents. Average total and soluble phosphorus concentrations in black water septic tank effluent is 18.6 and 15.2 mg/l, respectively. Average total Kjeldahl nitrogen concentration in gray septic tank effluent is 11.3 mg/l, 14 times lower than in black (toilet) effluent. Average concentrations of total and suspended solids, BOD, TOC, and COD in black and gray water effluents are the same order of magnitude. Average concentrations of total and fecal coliform organisms in gray water effluent is 240,000/ml and 14,000/ml, respectively. Kitchen wastewater contains large amounts of organic matter that have undergone little breakdown. Required time intervals between gray water septic tank cleanings are 8-10 times longer than cleaning time intervals recommended for normal household septic tanks. (Danovich-Wisconsin)
W80-03791

MICROBIAL IMPACT OF CANADA GEESE (BRANTA CANADENSIS) AND WHISTLING SWANS (CYGNUS COLUMBIANUS COLUMBIANUS) ON AQUATIC ECOSYSTEMS,
Maryland Univ., College Park. Dept. of Microbiology.
D. Hussong, J. M. Damare, R. J. Limpert, W. J. L. Sladen, and R. M. Weiner.
Applied and Environmental Microbiology, Vol 37, No 1, p 14-20, January, 1979. 1 Fig, 2 Tab, 24 Ref. EPA R804206 and R804207.

Descriptors: *Chesapeake Bay, *Canada goose, *Coliforms, *Whistling swan, *Excrement, Microorganisms, Bacteria, Geese(Wild), Migratory birds, Waterfowl, Water birds, Water pollution, Water pollution sources, Enteric bacteria, Pathogenic bacteria, Migration, Migratory patterns, Ecosystems, Environmental effects.

Healthy whistling swans and Canadian geese, migrating along the eastern U.S. Flyway in Chesapeake Bay, do not harbor detectable enteric, bacterial pathogens. Freshly collected fecal matter from caged birds and from autopsied wild swans and geese do not yield Salmonella sp. Furthermore, Salmonella sp was not recovered from the four aquatic roosting sites included in the study. A random selection of 75 E. coli isolates from various waterfowl yields seven enterotoxin-producing E. coli. Waterfowl harboring these enterotoxigenic E. coli are all confined to Lake Shore Pond. Most of the anaerobic bacteria isolated are Escherichia and Streptococcus sp. Wild birds harbor significantly more fecal coliforms that fecal streptococci while the reverse is true for captive and fasting birds. In a 24-h period, a single swan eliminates one billion and a goose 10 million fecal coliforms (FC). At an artificial pond, Lake Shore, 25 captive swans and geese were maintained. Before the birds entered Lake Shore Pond, FC was 1/100 ml and after 220 bird hours, the count rose to 2,400/ml. Despite waste quality deterioration, neither Salmonella nor Shigella were isolated from the water or sediment. At Canninghouse Cove, the largest natural waterfowl roosting site, sediment FC counts rose from 13 to 170 FC/100 ml during the bird season. This sufficiently high population index could result in shell-fishing restrictions. (Danovich-Wisconsin)
W80-03794

PREDICTION OF THE QUALITY OF WATER IN A PROPOSED IMPOUNDMENT IN SOUTHWESTERN WISCONSIN, USA,
Wisconsin Univ.-Madison. Dept. of Soil Science.
D. R. Keeney.
Environmental Geology, Vol 2, No 6, p 341-349, 1978. 4 Fig, 9 Tab, 17 Ref.

Descriptors: *Kickapoo River(WI), *Phosphorus, *Impoundments, *Impounded waters, *Nutrient loading, Nutrients, Nonpoint pollution, Eutrophication, Water quality, Nitrogen, Recreation, Lake La Farge(WI), Base flow, Forecasting, Agricultural runoff, Runoff, Flood control, Decision making, Multiple-purpose reservoirs, Vollenweider models.

Due to large estimates of nutrient loadings and resultant eutrophic water quality is proposed Lake La Farge impoundment on the Kickapoo River, Wisconsin, federal funding was withdrawn from the project. Phosphorus loadings to the impoundment are estimated to be 4.4 g/sq/ m/yr. To reach Vollenweider's permissible levels, P loadings must be 0.2 g/sq m/yr; this cannot be achieved since base flow contributes nearly one-third of total P loading. Runoff supplies a major portion of Nitrogen (39%) and P (30%) to the impoundment. Base flow is also an important nutrient source, providing 35% of N and 32% of P. Recognizable point sources (sewage treatment plants and farmyards) supply 26% and 37% of N and P, respectively. Tertiary sewage treatment for the small communities is difficult to justify economically. Area farms currently practice well-above-average conservation practices, and little improvement in nonpoint nutrient removal would occur without considerable expense. However, in-lake treatment to remove weeds and algae from high-use areas could be done at minimal costs. The large multipurpose impoundment providing flood control and reacreation was first proposed in the 1960s. Construction commenced in 1971-1972 while about 1970-1971 several environmental groups petitioned against completing the impoundment. Major contention involved recreational benefits which assumed water quality good enough for recreational use of the impoundment. (Danovich-Wisconsin)
W80-03801

SECONDARY TOXICOLOGY AND CONTAMINANTS OF ALGAE GROWN ON WASTEWATER,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
For primary bibliographic entry see Field 3C.
W80-03818

MECHANICAL HYDRILLA CONTROL IN ORANGE LAKE, FLORIDA,
Army Engineer District, Jacksonville, FL.
For primary bibliographic entry see Field 4A.
W80-03833

ADSORPTION-DESORPTION OF DIURON BY FRESHWATER SEDIMENTS,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
D. E. Peck, D. L. Corwin, and W. J. Farmer.
Journal of Environmental Quality, Vol 9, No 1, p 101-106, January-March 1980. 3 Fig, 7 Tab, 18 Ref. (California Water Resources Center Project UCAL-WRC-W-485).

Descriptors: *Adsorption, *Herbicides, *Pesticides, Sediments, Water quality, California, Diuron, Organic carbon, Temperature.

Freshwater sediments were collected from eight different locations in California to study the influence of sediment properties on the adsorption and desorption of the model herbicide, diuron (3-(3,4 dichlorophenyl)-1,1 dimethylurea). The sediments were characterized as to physical and chemical properties using the same methods used for soils. The sediments had a range of organic carbon of 0.91 to 19% and were high in silt and clay. The adsorption of diuron was described by the Freundlich equation. Adsorption at 25C expressed as the Freundlich coefficient, k, was positively correlated to the amount of organic carbon present. There was no correlation with total CEC. The desorption of diuron was evaluated by taking the difference between the slopes of the adsorption and desorption isotherms. As the difference between these slopes increased, less diuron was desorbed. These differences were positively correlated to k and organic carbon. Adsorption at temperatures of 5, 25, and 40C on three sediments indicated that the adsorption of diuron decreased as the temperature increased. (Snyder-California)
W80-03838

ORGANOCHLORINE INSECTICIDES AND PCBS IN SEDIMENTS OF LAKE ST. CLAIR (1970 AND 1974) AND LAKE ERIE (1971),
Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
For primary bibliographic entry see Field 5C.
W80-03894

5C. Effects Of Pollution

AN INTERIM REPORT ON THE INTENSIVE RIVER-QUALITY ASSESSMENT OF THE UPPER CHATTAHOOCHEE RIVER BASIN, GEORGIA,
Geological Survey, Doraville, GA.
For primary bibliographic entry see Field 5B.
W80-03609

TOWARD A CONCEPTUAL FRAMEWORK FOR RIVER-QUALITY TREND AND CAUSE-EFFECT ANALYSIS,
URS Co., Seattle, WA.
For primary bibliographic entry see Field 5B.
W80-03611

THE EFFECTS OF BOTTLE VOLUME, THALLUS WEIGHT, OXYGEN SATURATION LEVELS, AND WATER MOVEMENT ON APPARENT PHOTOSYNTHETIC RATES IN MARINE ALGAE,
California Univ., Irvine.
M. M. Littler.
Aquatic Botany, Vol 7, p 21-34, 1979. 5 Fig, 2 Tab, 30 Ref. (California Water Resources Center Project UCAL-WRC-W-491). OWRT-A-054-CAL(9).

Descriptors: *Marine algae, *Photosynthesis, *Weight, *Volume, *Movement, Photosynthetic oxygen, Aquatic life, Aquatic plants, Photosynthetic rates.

The importance of container volume, thallus weight, O2 tension, and water motion to measurements of photosynthetic rates in Ulva lobata (Kutz.) Setchel and Gardner (a species with a relatively high photosynthetic rate) and Colpomenia sinuosa (Roth) Derb. and Sol. (relatively low photosynthetic rate) were examined by means of O2 changes in bottles and through pH and O2 flux in continuously monitored chambers. The photosynthetic rate of Ulva averaged 36% lower in 310-ml bottles than in 1220-ml jars. Apparent photosynthesis varied as a function of (1) the initial dissolved O2 levels (regardless of bottle size), and (2) the particular metabolic reactions of the individual producers to different O2 tensions. Although similar trends were observed for Colpomenia, the effects of bottle size and initial O2 concentration were not as pronounced as for Ulva. The larger thallus weights of both species resulted in lower photosynthetic values, even in the large containers, due to clumping and self-shading of individual thalli. Mixing had a greater effect on apparent photosynthesis than on dark respiration, and was more critical for Ulva than for Colpomenia. Specific recommendations are put forth to deal with problems arising from the variations in methodology examined. (Snyder-California)
W80-03659

SEASONAL VARIATIONS IN NET PHOTOSYNTHETIC PERFORMANCE AND COVER OF INTERTIDAL MACROPHYTES,
California Univ., Irvine. Dept. of Ecology and Evolutionary Biology.
M. M. Littler, S. N. Murray, and K. E. Arnold.
Aquatic Botany, Vol 7, p 35-46, 1979. 1 Fig, 2 Tab, 32 Ref. (California Water Resources Center Project UCAL-WRC-W-491). OWRT-A-054-CAL(10).

Descriptors: *Macrophytes, *Photosynthesis, *Seasonal, *Fluctuations, *Intertidal areas, Benthos, Aquatic algae, Benthic flora, *Marine algae, Marine plants, Aquatic productivity, *San Clemente Island(Calif).

Standing stocks and net photosynthetic performances were determined concurrently for the 13 most abundant intertidal macrophytes from San Clemente Island, California over a four-season period. Highest net production rates were measured during summer for nine of the 13 species and minimum rates were recorded in spring and to a lesser extent during winter. Correlations between seasonal fluctuations in standing stock and productivity were evident for only eight species. Total daily community production reached a peak in the fall and declined sharply through winter to a spring low, closely paralleling changes in ambient water temperature. Blue-green algae, C. officinalis var. chilensis, P. capillacea, and E. menziesii contributed 76% of the total community primary productivity for the year. Seasonal patterns of photosynthetic performances were highly variable with a tendency for most species to attain peak daily photosynthetic rates coincident with higher temperatures and longer daylength. (Snyder-California)
W80-03660

THE REACTION OF PHRAGMITES COMMUNIS ROOTS TO DDT AND HEXACHLORANE,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
A. I. Merezhko, T. I. Shokod'ko, N. N. Smirnova, and M. B. Dontsov.
Hydrobiological Journal, Vol 14, No 4, p 100, 1978.

Descriptors: *Root systems, *Absorption, *Pesticide toxicity, DDT, Plant physiology, Plant growth, Mode of action, Root development, Rooted aquatic plants, Chlorinated hydrocarbon pesticides, Marsh plants, *Hexachlorane.

The absorption capacity of the root system of the reed Phragmites communis was studied using concentrations of DDT and hexachlorane ranging from 25 to 2000 microg/l. Low concentrations of pesticides (25 and 50 microg/l) inhibit the growth of adventitions roots in soil and water and reduce the total and active absorbing surface. In addition the cation exchange capacity and the anion exchange capacity of the roots are increased. A further increase in the concentrations of pesticides increased the total and active absorbing surface of the roots in water but decreased the same values in soil. The different reaction of the root systems to a change in pesticide concentration is hypothesized as a protective function ensuring a definite level of activity. (Deal-EIS)
W80-03661

EFFECT OF SOME CHEMICAL AGENTS ON THE UPTAKE OF 32P AND 65ZN BY MACROPHYTES IN THE BLACK SEA,
Institute of Biology of the Southern Seas, Sevastopol (USSR).
For primary bibliographic entry see Field 5B.
W80-03662

THE ABSORPTION OF DDT BY VASCULAR AQUATIC PLANTS,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
For primary bibliographic entry see Field 5B.
W80-03663

THE DISTRIBUTION AND ECOLOGY OF THE NAIDIDAE (OLIGOCHAETA) WHICH INHABIT THE FILTER-BEDS OF SEWAGE-WORKS IN BRITAIN,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
M. A. Learner.
Water Research, Vol 13, p 1291-1299, 1979. 2 Fig, 7 Tab, 20 Ref.

Descriptors: *Worms, *Dominant organisms, *Sewerage, Animal populations, Sewage treatment, Industrial wastes, Filtration, Oligochaetes, Water chemistry, Biochemical oxygen demand, Organic loading.

A survey of sewage filter-beds situated throughout Great Britain showed that naidid worms were frequently an important component of the faunal community. The three commonest species were Nais variabilis, N. elinguis, and Pristina idrensis. Their occurrence and abundance were determined principally by the organic loading received by the beds, the amount of film present, and the presence of industrial waste. All the species found are considered beneficial to the functioning of the filter-bed. (Deal-EIS)
W80-03666

IDENTIFICATION OF ORGANIC SULFUR COMPOUNDS TRANSFERRED TO FISH FROM PETROLEUM SUSPENSION BY MASS CHROMATOGRAPHY,
Okayama Univ. (Japan). Dept. of Public Hygiene.
For primary bibliographic entry see Field 5B.
W80-03671

MACROINFAUNAL STRUCTURE AND EFFECTS OF THERMAL DISCHARGES IN A MESOHALINE HABITAT OF CHESAPEAKE BAY, NEAR A NUCLEAR POWER PLANT,
Academy of Natural Sciences of Philadelphia, PA.
T-N. Loi, and B. J. Wilson.
Marine Biology, Vol 55, p 3-16, 1979. 11 Fig, 2 Tab, 61 Ref.

Descriptors: *Biological communities, *Toxicity, *Nuclear powerplants, *Chesapeake Bay, Maryland, Water temperature, Heated water, Thermal stress, Sampling, Benthic fauna, Dominant organisms, Bottom sediments, Seasonal, Mollusks, Clams, Habitats, Mathematical models, Calvert Cliffs Nuclear Power Plant, *Species diversity, *Species diversity indices, *Polychaetes, *Shannon-Wiener index.

The soft-bottom macroinfauna of the Chesapeake Bay near the Calvert Cliffs Nuclear Power Plant, Maryland, USA, was studied quarterly in 1977. A total of 42,900 organisms distributed among 55 taxa was taken in 180 Smith-McIntyre grabs. Two communities and an ecotone between these two communities were identified in association with three sediment types: sand, sand-clay, and clay. Reproductive activities of 8 numerically dominant species are described. The macroinfauna at Calvert Cliffs was largely seasonal; species richness and organism abundances were lowest in late summer. The polychaetes Scolecolepides viridis and Heteromastus filiformis and the bivalves Macoma balthica and Mya arenaria were dominant in March-June. In September-December, the polychaetes Neanthes succinea, Paraprionospio pinnata, and Glycinde solitaria and the bivalve Gemma gemma became dominant. There were clear indications of differences associated with sediment types in total number of species, total number of individuals, and abundances of the dominant species. The shallower and intermediate habitats had higher sand-clay ratios, lower organic carbon contents, and larger numbers of organisms than the deeper clay habitat. Within each depth, no apparent detrimental effects caused by the thermal discharges on total number of species, total number of individuals, abundances of the dominant species, species diversity or evenness were found. (Deal-EIS)
W80-03672

COMPARISON OF VARIOUS METHODS FOR ESTIMATING THE QUALITY OF WATER BASED ON BOTTOM-DWELLING INDICATOR INVERTEBRATES,
Ukranian Hydrobiology Inst. Kherson (USSR). Kherson Hydrobiological Station.
For primary bibliographic entry see Field 5A.
W80-03673

VARIATION IN THE REACTIONS OF DAPHNIA MAGNA STRAUS TO THE EFFECT OF A TOXICANT AS RELATED TO ITS DELIVERY REGIME,
Kaspiiskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Astrakhan (USSR).
For primary bibliographic entry see Field 5A.
W80-03676

ZOOPLANKTERS AS BIOINDICATORS OF WATER QUALITY,
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
M. F. Polivannaya, and O. A. Sergeyeva.
Hydrobiological Journal, Vol 14, No 3, p 39-43, 1978. 3 Fig, 1 Tab, 8 Ref.

Descriptors: *Bioindicators, *Zooplankton, *Water quality, Biological communities, Dominant organisms, Toxicity, Mathematical models, Trophic level, Mesotrophy, Oligotrophy, Biomass, Daphnia, Aquatic insects, Nematodes, Crustaceans, Water pollution effects, Aquatic populations, *Species diversity, *Species diversity indices.

The purpose of this study was to conduct a comparative evaluation of methods of biological analysis of water quality by using, as an example, zooplankton of the Dnieper River and the Kanev reservoir (USSR). Our material consisted of samples collected in the river in 1969 and 1972, and in the reservoir in 1975. The results indicate that pollution leads to less varied species composition of the zooplankton. The first to suffer are crustaceans and, among them, the nonpredator forms. Polyphagous insects (Asplanchnidae, Brachionus calyciflorus, Brachionus angularis and predator Cyclopoidae) tend to maintain themselves in the plankton. The data indicate an abrupt dip of the number of zooplankton dominants in river zones subjected to pollution and that the percentage of a few species under these circumstances. Age composition, replenishment and loss, fertility, morphometric characters of populations of leading species under normal conditions and during disturbances associated with pollution may serve as supplementary indices of water quality that are calculated in terms of zooplankton. (Deal-EIS)
W80-03678

DEPENDENCE OF THE TIME OF GAMETE MATURATION AND SPAWNING ON ENVIRONMENTAL TEMPERATURE IN THE VIRGINIA OYSTER CRASSOSTREA VIRGINICA,
Akademiya Nauk SSSR, Petrozavodsk. Dept. of Water Problems.
Z. F. Kaufman.
Hydrobiological Journal, Vol 14, No 4, p 29-30, 1978. 1 Fig, 5 Ref.

Descriptors: *Water temperature, *Toxicity, *Growth rates, *Oysters, Animal growth, Spawning, Reproduction, Mathematical models, Thermal stress, Animal physiology.

An equation is given in which the rate of gametogenesis, and the time of the first spawning and of mass spawning are a function of environmental temperature. All three processes were governed by van't Hoff's rule in the 20-30C range, i.e., an increase in temperature by 10C increased their rate by 2-3 times. This pattern was significantly altered in the range 15-20C. The rate of appearance of the first eggs was speeded up 4-fold, the time to the first spawning was reduced 1/5, and the time to mass spawning to 1/8. (Deal-EIS)
W80-03679

THE RELATIONSHIP BETWEEN VERTEBRAL NUMBER AND WATER TEMPERATURE IN COD,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Fisheries Lab.
For primary bibliographic entry see Field 5A.
W80-03680

IMPACT OF NUTRIENT ENRICHMENT IN A WATERCHESTNUT ECOSYSTEM AT TAKAHAMA-IRI BAY OF LAKE KASUMIGAURA, JAPAN, II ROLE OF WATERCHESTNUT IN PRIMARY PRODUCTIVITY AND NUTRIENT UPTAKE,
Tsukuba Univ., Sakuramura Ibaraki (Japan). Inst. of Biological Sciences.
For primary bibliographic entry see Field 5B.
W80-03681

A REVIEW OF THE LETHAL AND SUBLETHAL EFFECTS OF MERCURY ON AQUATIC LIFE,
Imperial Chemical Industries Ltd., Brixham (England). Brixham Research Lab.
For primary bibliographic entry see Field 5A.
W80-03683

INVESTIGATIONS ON THE EFFECTS OF DOMESTIC SEWAGE ON THE BENTHIC ECOSYSTEM OF MARINE INTERTIDAL FLATS (IN GERMAN),
Hamburg Univ. (Germany, F.R.). Inst. fuer Hydrobiologie und Fischerei-wissenschaft.
G. Otte.
Helgolander wissenschaftlichen Meeresuntersuchungen, Vol 32, p 73-148, 1979. 183 Ref.

Descriptors: *Sewage effluents, *Toxicity, *Aquatic life, Benthic flora, Benthic fauna, Intertidal areas, Outfall sewers, Domestic wastes, Sewage disposal, Waste water disposal, Water chemistry, Primary productivity, Bacteria, Dominant organisms, Bioindicators, Sylt, Germany, Vancouver, British Columbia, *Species diversity.

Primary productivity of microalgae on the sediment surface was positively correlated with the degree of pollution. In heavily and mediumly polluted zones, heterotrophic bacterial production exceeded primary production rates at the sediment surface. Compared with unpolluted intertidal flats the number of macro-benthic species was not reduced in polluted mud flats. In regard to overall species abundance, the macrofauna associations of the disposal area showed three distinct zones: (1) Heavy pollution around the outfall resulted in a degradation zone either without benthic invertebrates or with a very low density of individuals; (2) medium polluted areas were characterized by a zone of maximum density; (3) with decreasing or diminishing pollution the number of individuals returned to normal values ('background values'). The distribution of species within these zones indicated a significant difference between the response of the 'channel fauna' and the 'flat fauna' to pollution: while the number of species increased continously inside the channels with decreasing pollution, the species variety of the tidal flats was positively correlated with the number of individuals. The diversity of the benthos inside the channels was negatively correlated with the degree of pollution, whereas the diversity indices for the fauna on the tidal flats increased quickly from the centre of pollution, remained at a high level in the medium polluted zone, and decreased again to the area of diminishing pollution. (Deal-EIS)
W80-03684

IN VITRO INHIBITION OF THREE PHOSPHATASES BY MERCURIC CHLORIDE AND THEIR REVERSAL BY CHELATING AGENT EDTA,
D.A.V. Coll., Muzaffarnagar (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-03685

TRANSFER OF 14C-TOLUENE FROM MOSQUITO LARVAE TO BLUEGILL SUNFISH,
Aerospace Medical Research Lab., Wright-Patterson AFB, OH.
For primary bibliographic entry see Field 5B.
W80-03686

MOBILIZATION OF ORGANOCHLORINES FROM FEMALE LIPID TISSUE AND TRANSPLACENTAL TRANSFER TO FETUS IN A HARBOUR PORPOISE (PHOCOENA PHOCOENA) IN A CONTAMINATED AREA,
Nederlands Inst. voor Onderzoek der Zee, Texel.
For primary bibliographic entry see Field 5B.
W80-03687

EFFECTS OF ARTIFICIAL ACID RAIN ON MICROBIAL ACTIVITY AND BIOMASS,
Lund Univ. (Sweden). Dept. of Microbial Ecology.
E. Baath, B. Lundgren, and B. Soderstrom.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 737-740, 1979. 1 Tab, 9 Ref.

Descriptors: *Acidic water, *Acidic soils, *Rain, Acidity, Hydrogen ion concentration, Rainfall, Artificial precipitation, Water chemistry, Bacteria, Fungi, Respiration, Physiology, Growth rates, Biomass, Soils, *Acid rain.

Respiration, FDA-active fungal length and FDA-active bacteria are all parameters related to microbial activity in the soil. These parameters all decreased in the acidified plots (Tab. 1). Total fungal length and bacterial numbers did not change significantly in response to artificial acid rain, indicating that the microbial immobilization of mineral elements was little affected in this experiment. Bacterial cell size was smaller in the most acidified plots. Mean cell size in this treatment was 0.10, m3, compared to 0.13, m3 in the control and the pH 3 treated plot. The reduced cell size could be due to changes in the bacterial population, or it could reflect a lower bacterial growth rate after treatment with pH 2 water. It seems most likely that the decreased microbial activity, directly or indirectly, is a hydrogen ion effect. However, since pH was adjusted with sulphuric acid, it cannot be excluded that the added sulphate influenced the microorganisms negatively. (Deal-EIS)
W80-03688

COPPER TOXICITY TO THE BAY SCALLOP (ARGOPECTEN IRRADIANS),
Environmental Research Lab., Narragansett, RI.
G. Pesch, N. Stewart, and C. Pesch.
Bulletin of Environmental Contamination & Toxicology, Vol 23, p 759-765, 1979. 2 Fig, 1 Tab, 21 Ref.

Descriptors: *Copper, *Toxicity, *Mollusks, Growth rates, Mortality, Animal behavior, Juvenile growth stage, Animal physiology, Animal metabolism, Lethal limit, Bioindicators, Inhibition, *Bioaccumulation, *Tissue analysis, *Scallops, *Argopecten.

The purpose of this study was to examine the effect of copper on survival, growth, and byssal attachment, and copper accumulation of juvenile bay scallops in a flowing water exposure system. At each of the 4 highest concentrations (110, 48, 21, and 11 microg/l) more than half of the scallops died during the 42-day experiment. At the lowest concentration, 5 microg/l, 10% of the scallops had died by day 42. An incipient LC50 value of 9.3 microg/l Cu was estimated graphically from the toxicity curve. Growth was inhibited at all concentrations. At the 4 highest concentrations (110, 48, 21, and 11 microg/l), we observed that before death the scallops detach from their substrates and lie free on the bottom of the aquaria. The response of the scallops to copper indicates an initial acute effect as shown by the detachment. However, some of the survivors adjusted to the presence of copper and reattached. The relationship between detachment and death was linear. Accumulation of copper by bay scallops in this study is comparable to data from other studies that show molluscs accumulate copper readily and elevated copper concentrations in the environment are reflected by elevated copper concentrations in molluscs. (Deal-EIS)
W80-03689

THE EFFECTS OF THE ANAESTHETIC QUINALDINE ON OXYGEN CONSUMPTION IN AN INTERTIDAL TELEOST BLENNIUS PHOLIS (L.),
Plymouth Polytechnic (England) School of Environmental Sciences.
For primary bibliographic entry see Field 5A.
W80-03690

ORGANOCHLORINE, FLUORINE, AND HEAVY-METAL LEVELS IN SOME BIRDS FROM NEW ZEALAND ESTUARIES,
Department of Agriculture, Wellington (New Zealand). Wallaceville Animal Research Center.
For primary bibliographic entry see Field 5B.
W80-03691

EVALUATION OF SAPROBICITY OF THE VOLGOGRAD RESERVOIR IN TERMS OF THE PHYTOPLANKTON,
Akademiya Nauk SSSR, Borok. Inst. Biologii Vnutrennykh Vod.
A. G. Okhapkin, and G. V. Kuz'min.
Hydrobiological Journal, Vol 14, No 3, p 35-39, 1978. 2 Fig, 3 Tab, 11 Ref.

Descriptors: *Productivity, *Phytoplankton, *Reservoirs, Seasonal, Aquatic populations, Sewage effluents, Trophic level, Dominant organisms, Diatoms, Aquatic algae, Cyanophyta, Mesotrophy, Oligotrophy, Monitoring.

The saprobicity of the Volgograd reservoir and ratio of indicator species changed during the vegetative period. The peak saprobicity indexes in summer dropped due to intensification of self-purification processes. In autumn they were almost the same as in summer. The saprobicity of the water downstream of cities increased due to effluents. A comparison with the data available in literature showed a gradual rise in saprobicity of the Volga from 1902 to the present. (Deal-EIS)
W80-03694

THE FIELD ASSESSMENT OF EFFECTS OF DUMPING WASTES AT SEA: 3. A SURVEY OF THE SEWAGE SLUDGE DISPOSAL AREA IN LYME BAY,
Ministry of Agriculture, Fisheries and Food, Lowestoft (England). Directrorate of Fisheries Research.
For primary bibliographic entry see Field 5A.
W80-03696

EYE DAMAGE TO THE GRASS CARP (CTENOPHARYNGODON IDELLA) FROM CHRONIC UPTAKE OF STRONTIUM 90,
Akademiya Nauk Kazakhskoi SSR, Alma-Ata. Inst. Zoologii.
V. I. Nilov, V. M. Fedoseyenko, and I. A. Shekhanova.
Journal of Ichthyology, Vol 16, p 1001-1006, 1976. 5 Fig, 14 Ref.

Descriptors: *Carp, *Fish diseases, *Strontium radioisotopes, Absorption, Path of pollutants, Radiochemical analysis, Animal pathology, Radioisotopes, Growth stages, Fish physiology, Animal metabolism, *Tissue analysis.

An investigation was made of the distribution of strontium 90 in the eye tissues of the grass carp (Ctenopharyngodon idella) from the chronic uptake of this radionuclide. It was found that the nature of the distribution of strontium 90 in the eye tissues was not identical. The largest amount of the isotope is found in the lens, the least amount in the retina. Localization of strontium 90 is observed in the photoreceptor cells on the outer membrane of the segments of the cones and rods and on their disk membranes. The chronic uptake of the radionuclide by grass carp fingerlings over a period of 2 months led to pathological changes in the eye tissues. (Deal-EIS)
W80-03697

FISH MORTALITY AND FISHING DURING AN UNPRECEDENTED DRAUGHT IN LAKE PICHHOLA, UDAIPUR,
Udaipur Univ. (India). Dept. of Zoology.
For primary bibliographic entry see Field 2H.
W80-03698

PESTICIDES AND AQUATIC ECOSYSTEMS,
Kalyani Univ., West Bengal, (India). Dept. of Zoology.
S. K. Konar.
India Journal of Fisheries, Vol 22, p 80-85, 1975. 3 Fig, 22 Ref.

Descriptors: *Pesticide toxicity, *Public health, *Ecosystems, Pesticide kinetics, Fishkills, Carp,

Catfishes, Cytological studies, Pesticide residues, Mortality, *Tissue analysis, *DDVP, *Parathion, *Phosphamidon, *Bioaccumulation, India, Punarbhava River.

A survey made in West Bengal to evaluate the influence of pesticides on aquatic ecosystems showed that pesticides killed many fishes in Punarbhava River, West Dinajpur, in August 1970. The paddy fields near the river recieved the insecticides: DDVP, phosphamidon and parathion. The tissues of gills, alimentary tract, liver and brain of the exposed carp (Labeo rohita) and catfish (Heteropneustes fossilis) were found severely damaged. The pesticide residue in fish was in levels that may cause hazard to fish eaters. (Deal-EIS)
W80-03699

ROTENONE RESISTANCE OF GOLDEN SHINERS FROM A PERIODICALLY RECLAIMED POND,
Connecticut Dept. of Environmental Protection, Middlebury.
For primary bibliographic entry see Field 5A.
W80-03702

DYNAMICS AND BEHAVIORAL TOXICOLOGY OF AQUA-KLEEN (TRADE NAME) (2,4-D BUTOXYETHANOL ESTER) AS REVEALED BY THE MODIFICATION OF RHEOTROPISM IN RAINBOW TROUT,
Waterloo Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5A.
W80-03703

THE INFLUENCE OF ACCLIMATION TEMPERATURE ON THE INTERACTIONS OF CHLORINE, ELEVATED TEMPERATURE, AND EXPOSURE DURATION FOR GRASS SHRIMP, PALAEMONETES PUGIO,
Academy of Natural Sciences of Philadelphia, Benedict, MD. Benedict Estuarine Research Lab.
For primary bibliographic entry see Field 5A.
W80-03704

STUDIES ON THE EFFECTS OF ACIDIC MEDIUM ON THE FRY OF CYPRINUS CARPIO,
Holkar Science Coll., Indore (India). Dept. of Zoology.
For primary bibliographic entry see Field 5A.
W80-03706

THE EFFECTS OF OYSTER SHELL DREDGING ON AN ESTUARINE BENTHIC COMMUNITY,
University of South Florida, Tampa. Dept. of Biology.
For primary bibliographic entry see Field 2L.
W80-03734

TAXONOMIC NOTES ON EPIPHYTIC DIATOMS OF MISSISSIPPI SOUND, U.S.A.,
Mississippi State Univ., Mississippi State. Dept. of Biological Sciences.
M. J. Sullivan.
Nova Hedwigia, Vol 64, p 241-249, 1979. 1 Fig, 7 Ref, 4 Pl. OWRT A-114-MISS (3), 14-34-0001-8026.

Descriptors: *Diatoms, *Systematics, *Electron microscopy, *Sessile algae, *Rooted aquatic plants, Ecological distribution, Biogeography, Marine algae, Submerged plants, Aquatic habitats, Mississippi, *Epiphytic algae, *Seagrasses, Horn Island(Miss. Sound), Halodule, Syringodium, Thalassia.

Epiphytic diatoms were collected from the leaves of three seagrass species (Halodule beaudettei, Syringodium filiforme, and Thalassia testudinum) in Mississippi Sound during the summer of 1977. A previous paper by the author showed that nearly identical diatom communities were found on each seagrass based on the distribution of the more abundant taxa and statistical comparisons. The present paper provides taxonomic information on selected diatom taxa using light and scanning electron microscopy. Of the eight taxa treated, five are araphid forms. Descriptions of the majority of these taxa based on light microscope observations are herein amplified by examination of cleaned material under the scanning electron microscope.
W80-03781

EFFECTS OF DINOFLAGELLATE BIOLUMINESCENCE ON THE INGESTION RATES OF HERBIVOROUS ZOOPLANKTON,
Old Dominion Univ., Norfolk, VA. Inst. of Oceanography.
H. S. White.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 3, p 217-224, February, 1979, 2 Fig, 22 Ref.

Descriptors: *Bioluminescence, *Dinoflagellates, *Grazing, *Predation, *Copepods, Zooplankton, Cytological studies, Regression analysis, Animal physiology, Florescence, Cultures, Digestion, Diets, Feeding rates, Food habits, Animal populations, Denisty, Swimming, Movement.

Acartia tonsa, a copepod, grazes more slowly on the Dingflagellate Gonyaulax excavata when the latter is highly luminescent, except at lowest experimental concentrations (<500 cells/ml). Natural zooplankton organism concentrations cannot exhaust bioluminescence of healthy Gonyaulax excavata cells. Highly luminescent culture depress grazing rates 50-75% relative to weakly and very weakly bioluminescent cultures. The regression line slope for highly luminescent cultures is significantly different from that of the other two (P=0.99). In-situ grazing rates on dinoflagellates fluctuate in response to changes in cell bioluminescent capacity. This is especially true at high cell densities, such as exist during a bloom. Culture experiments used one animal/3 ml (333 animals/1), however, normal natural concentrations are considerably lower. A. clausi stimulates 0.3-2.2% (average 1.1%) of the luminescent capacity per minute, while Pseudocalanus minutus stimulates only 0.0-0.1%, indicating interspecific differences. Therefore, bioluminescence may not equally deter all predator types. A. clausi copepods move in a series of short darts forward, while P. minutus moves in a smooth glide. The latter swimming apparently does not shear cells with a force above emission threshold. Results suggest dinoflagellate bioluminescence effectively reduces predator grazing and cell populations have sufficient emission capacity to respond to continual animal activity. (Danovich-Wisconsin)
W80-03782

CARNIVOROUS FEEDING BEHAVIOR OF THE ADULT CALANOID COPEPOD ACARTIA TONSA DANA,
Maryland Univ., Solomons. Chesapeake Biological Lab.
D. J. Lonsdale, D. R. Heinle, and C. Siegfried.
Journal of Experimental Marine Biology and Ecology, Vol 36, No 3, p 235-248, February, 1979. 7 Fig, 2 Tab, 42 Ref. ERDA AT-(401-1)14848, NSF SMI76-03130.

Descriptors: *Copepods, *Predation, *Food habits, *Animal behavior, Size, Algae, Diets, Digestion, Speciation, Denisty, Growth stages, Foods, Food abundance, Carnivores, Omnivores, Cultures, Laboratory tests, Ecology, Regression analysis.

Significantly high predation rates of Acartia tonsa on its potential competitors may affect copepod seasonal variation and species composition. A. tonsa flexibility in exploiting food resources may be the major reason why this copepod dominates estuarine and coastal waters. Laboratory experiments observed carnivorous feeding behavior of A. tonsa, a calanoid copepod known to be omnivorous. A. tonsa adults feed on various copepod nauplii species including A. tonsa, Scottolana canadensis, Oithona colcarva, and Eurytemora affinis. Selection experiments show A. tonsa adults avoid A. tonsa nauplii as prey and prefer E. affinis and S. canadensis nauplii. Preconditioning A. tonsa adults with one of the three nauplii species does not alter this selection against A. tonsa nauplii. Naupliar size is also important; smaller sized prey are usually preferred. Ingestion rate of Pseudoisochrysis (algae) by adult A. tonsa (0-1.23 million cu micro m/adult h) with no nauplii available increases with algal concentration (0.16-1.51 ppm). Ingestion rate of algae (0-1.48 million cu micro m/adult h) with an alternate food source, either A. tonsa or S. canadensis nauplii, also increases with algal concentration (0.14-2.35 ppm). A. tonsa adult predation rates on A. tonsa nauplii increases with greater prey densities. This is observed with algae present or absent. (Danovich-Wisconsin)
W80-03783

THE EFFECTS OF VERTICAL STABILITY ON PHYTOPLANKTON DISTRIBUTIONS IN THE SUMMER ON THE NORTHWEST EUROPEAN SHELF,
Institute of Oceanographic Sciences, Wormley (England).
R. D. Pingree, P. M. Holligan, and G. T. Mardell.
Deep-Sea Research, Vol 25, No 11, p 1011-1028, November 1978. 11 Fig, 2 Tab, 28 Ref.

Descriptors: *Phytoplankton, *United Kingdom, *Continental shelf, *Water circulation, *Vertical distribution, Mixing, Distribution, Tides, Tidal effects, Water temperature, Chlorophyll, Depth, Nutrients, Winds, Thermal stratification, Mathematical models, Hydrologic aspects, Growth rates, Upwelling, Wind tides, Summer, Primary productivity, Diatoms, Dinoflagellates.

Phytoplankton distributions in frontal regions on the Northwest European Shelf, July 1977, are interpreted in terms of tidal energy dissipation rate per unit mass, E, and water depth scaled by the extinction coefficient. These two parameters largely determine the physical environment in which phytoplankton growth and the area between $-2.0<E<-1.0$, which includes frontal boundaries and shallow thermoclines, defines the most productive region during summer months. Data were analyzed for separate geographical areas; western North Sea, northwestern North Sea, between Scotland and Ireland and Celtic Sea and western English Channel. In weakly-stratified and well-mixed waters diatoms are most abundant. Species composition varies from benthic types inshore to neritic and more oceanic communities; few dinoflagellates are found. In surface waters overlying well-developed thermoclines, chlorophyll-a levels are generally low and dinoflagellates are dominant. Phytoplankton populations in the thermocline are in three groups according to surface-to-bottom temperatures differences (TD): TD<3 C, dinoflagellates and diatoms; TD 3-6 C, dinoflagellates; and TD>6 C, flagellates. In frontal regions, mixed populations of dinoflagellates and diatoms form high chlorophyll concentrations. Species composition differences probably reflect variations in nutrients. Chlorophyll-a distributions relate to availability of light and inorganic nutrients for phytoplankton growth which, in turn, are determined by vertical stability, depth and turbidity of the water column. (Danovich-Wisconsin)
W80-03784

CHEMICAL FLUCTUATIONS DUE TO SEASONAL AND CROPPING EFFECTS ON AN ALGAL-SEAGRASS COMMUNITY,
University of South Florida, Tampa. Dept. of Biology.
For primary bibliographic entry see Field 2I.
W80-03785

THE NUTRITIONAL ECOLOGY OF CYPERUS ESCULENTUS, AN EMERGENT AQUATIC PLANT, GROWN ON DIFFERENT SEDIMENTS,
Army Engineer Waterways Experimental Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 2I.
W80-03786

AEROMONAS DISTRIBUTION AND SURVIVAL IN A THERMALLY ALTERED LAKE,
Du Pont de Nemours (E.I.) and Co., Aiken, SC. Savannah River Lab.

For primary bibliographic entry see Field 4A.
W80-03787

NITRATE AND PHYTOPLANKTON PRODUCTION IN SOUTHERN CALIFORNIA COASTAL WATERS,
Scripps Institution of Oceanography, La Jolla, CA.
R. W. Eppley, E. H. Renger, and W. G. Harrison.
Limnology and Oceanography, Vol 24, No 3, p 483-494, May, 1979. 7 Fig, 40 Ref. USDOE EY-76-C-03-0010, PA20.

Descriptors: *Nitrates, *Primary productivity, *Phytoplankton, *Coasts, *Southern California, *Euphotic zone, Standing stocks, Equations, Environmental gradient, Carbon, California, Photosynthesis, Diffusion, Correlation analysis, Testing, Upwelling, Nutrients, Nutrient transport, Depth, Diffusivity, Biochemistry, Marine biology.

Nitrate transport into the euphotic zone is the major factor regulating phytoplankton standing stock and production in southern California coastal waters. This was tested by examining the null hypothesis that phytoplankton production is independent of nitrate input rates to the euphotic zone. The null hypothesis is rejected due to the low surface nitrate concentration, 0.5 micro g-at/l, in southern California coastal waters, except during strong upwelling. Carbon and nitrate assimilation rates are related; rank difference correlation coefficient is 0.73, implying that 53% of the variation in either variable is explainable by its correlation with the other. Further evidence includes the following: (1) Phytoplankton standing stock and production rate relate to vertical nitrate concentration gradient depth. (2) Particulate organic matter chemical composition, expressed as POC:PON ratio, relates to phytoplankton C:N assimilation ratio. (3) Regenerated production, measured as ammonium assimilation, is proportional to nitrate assimilation rate, implying parallel and concurrent increases in heterotrophic microplankton and phytoplankton production due to new euphotic zone nitrate inputs. (4) Vertical nitrate diffusion, when calculated from vertical nitrate concentration gradients and nitrate assimilation rates, reasonably estimates vertical eddy diffusivity for nitrate. Eleven quarterly cruises in the Southern California Bight, February 1975-August 1977, provided data for this report. (Danovich-Wisconsin)
W80-03789

VERY SIMPLE MODEL OF THE INITIAL STAGE OF OLIGOTROPHIC-EUTROPHIC SUCCESSION. IN BODIES OF WATER,
Moscow State Univ., (USSR).
For primary bibliographic entry see Field 5A.
W80-03792

THE EFFECT OF PHOSPHATE AND TEMPERATURE ON GROWTH OF ACTIVATED SLUDGE AND ON BIODEGRADATION OF SURFACTANTS,
Water Pollution Research Lab., Stevenage (England).
For primary bibliographic entry see Field 5D.
W80-03793

THE DISTRIBUTION OF ALGAL EPIPHYTES ON MACROPHYTE HOSTS OFFSHORE FROM LA PARGUERA, PUERTO RICO,
Puerto Rico Univ., Mayaguez. Dept. of Marine Sciences.
D. L. Ballantine.
Botanica Marina, Vol 22, No 2, p 107-110, February 1979. 1 Fig, 2 Tab, 19 Ref.

Descriptors: *Marine algae, *Epiphytology, *Distribution, *Hosts, *La Parguera, Puerto Rico, Marine plants, Caribbean Sea, Bryothamnion triquetrum, Laurencia poitei, Digenia simplex, Dasya pedicellata, Halymenia floresia, Crysemenia enteromorpha, Ceramium byssoideum, Polysiphonia havanensis, Calithamnion byssoides, Microcoleus lyngbyaceus, Plant pathology, Distribution patterns, Biological communities, Age, Macrophytes, Algae.

During August 1973 - May 1976, 122 species of epiphytes were identified from an algal plain located two miles off the southwest coast of Puerto Rico. Hosts vary in ability to support epiphytic communities. Bryothamnion triquetrum, Laurencia poitei and Digenia simplex generally support abundant epiphytes. Large plants of Dasya pedicellata, Halymenia floresia and Crysymenia enteromorpha are frequently devoid of epiphytes. On almost all hosts, a general zonation pattern of epiphytes is observed. Epiphytism is heaviest on older portions of host plants. It is lightest near meristematic regions. On favorable hosts, epiphytes are distributed closer to apical tips than on non-favorable hosts, although colonization is heaviest on older portions in both types of hosts. Composition of epiphytic species also commonly differs between young and old portions of algal hosts. On uppermost portions of favorable hosts the most common epiphytic species are Ceramium byssoideum, Polysiphonia havanensis, Calithamnion byssoides and Microcoleus lyngbyaceus; on non-favorable hosts these species are sometimes the only epiphytes present. Proceding from younger to older portions of the host, the colonizing species become more abundant and diverse. Oldest host portions are occasionally totally covered with epiphytes. Here the cover of the calcareous Melobesiacean crust frequently approaches 100%. Coralline red algae Corallina, Jania and Amphiroa commonly grow over the crust. (Harris-Wisconsin)
W80-03797

THE MICRODISTRIBUTION OF EPIPHYTES ON THE LEAVES OF NATURAL AND ARTIFICIAL MACROPHYTES,
McGill Univ., Montreal, (Quebec). Dept. of Biology.
A. Cattaneo.
British Phycological Journal, Vol 13, No 2, p 183-188, June 1978. 7 Fig, 1 Tab, 9 Ref.

Descriptors: *Epiphytology, *Artificial substrates, *Laboratory tests, *Microenvironment, *Distribution, Chlorophyta, Epiphytes, Cocconeis placentula, Eunotia spp., Analytical techniques, Coleochaete orbicularis, Coleochaete nitellarum, Diatoms, Leaves, Algae, Colonization, Plant pathology, Macrophytes.

Microdistribution of two diatoms (Cocconeis placentula and Eunotia spp.) and two epiphytic green algae (Coleochaete orbicularis and C. nitellarum) on leaves of Potamogeton richardsonii and on those of plastic aquarium plants was compared. Eunotia spp. and Coleochaete orbicularis were significantly more abundant on the underside of natural leaves while C. nitellarum significantly preferred the upper side. There were no significant differences among these taxa in their colonization of the two sides of artificial leaves; however, C. placentula showed a significant preference for the upper side of plastic leaves but had no similar preferences on natural plants. Differential colonization on the upper side and underside of natural leaves by Eunotia spp. and C. orbicularis is attributed to calcium trioxide incrustation on upper sides of leaves. These incrustations reduced colonization space. Diatoms showed significant preference for edges on both natural and plastic leaves. Intense development of green algae on lamina was noted on plastic leaves only. Preference of colonizing leaf margins by diatoms and green algae is possibly related to more favorable illumination and/or nutrient renewal at those parts of the host leaf. (Harris-Wisconsin)
W80-03798

PHYTOPLANKTON DISTRIBUTION AND LIGHT ATTENUATION IN PORT HACKING ESTUARY,
Commonwealth Scientific and Industrial Research Organization, Cronulla (Australia). Div. of Fisheries and Oceanography.
B. D. Scott.
Australian Journal of Marine and Freshwater Research, Vol 29, No 1, p 31-44, February 1978. 8 Fig, 1 Tab, 20 Ref.

Descriptors: *Phytoplankton, *Distribution, *Attenuation, *Light, *Estuarine environments, Photosynthesis, Port Hacking Estuary, Australia, Australia, Vertical distribution, Horizontal distribution, Chlorophyll-a, Estuaries, Fluorescence, Solar radiation, Detritus, Suspended solids, Sedimentation, Biomass, Spatial distribution.

In-vivo chlorophyll fluorescence, phytoplankton photosynthesis rates at constant irradiance, and solar irradiance attenuation by water columns were measured in sea water samples taken from Port Hacking estuary near Sydney, Australia, in order to obtain phytoplankton distribution patterns. Five general conclusions are derived: (1) Phytoplankton distribution within the South West Arm in Port Hacking estuary is almost uniform horizontally. Vertical distribution is rarely uniform, with manima occuring at depths of 2-6 m. (2) Although horizontal phytoplankton distribution is fairly uniform, distribution can be grouped according to locality and magnitude. The magnitude and similarity of chlorophyll to photosynthesis in ratios of these groups indicates that phytoplankton biomass adjusts so that it is optimal to nutrient flux. (3) Attenuation of solar radiation by the water columns is near uniform both horizontally and vertically, with attenuation coefficients with 10% of the mean value within South West Arm except in times of heavy rainfall when introduced sediments occur in the upper 6 m of the water column. (4) Secimentation removes more than 22% of the suspended sediments and phytoplankton from the water column. (5) Because phytoplankton contribution to the total attenuation coefficient is only 0.013 per meter, the chlorophyll-attenuation relationship is of limited use in estimating optical properties of the water column from chlorophyll measurements. (Harris-Wisconsin)
W80-03799

APPLICATION OF IN SITU CAGE CULTURES OF PHYTOPLANKTON FOR MONITORING HEAVY METAL POLLUTION IN TWO NORWEGIAN FJORDS,
Trondheim Univ., (Norway). Inst. of Marine Biochemistry.
I. Eide, A. Jensen, and S. Melsom.
Journal of Experimental Marine Biology and Ecology, Vol 37, No 3, p 271-286, March 22, 1979. 4 Fig, 6 Tab, 30 Ref.

Descriptors: *On-site data collections, *Heavy metals, *Fjords, *Cultures, *Diatoms, *Research equipment, *Industrial wastes, Monitoring, Sampling, Water pollution sources, Zinc, Lead, Absorption, Cadmium, Mercury, Norway, Orkdalsfjord, Norway, Trondheims-fjord, Norway, Sorfjord, Norway, Hardangerfjord, Norway, Growth rates, Environmental effects.

A simple field apparatus for cage cultivation of marine planktonic algae consist of a perforated Perspex box 35 cm per side rope-suspended by a buoy at one m depth. A rotor with algal cultures contained in dialysis tubing is turned inside the box by an electrically driven sealed magnet. A tube containing a chelating resin and fitted with a filter is also attached; water is drawn continuously through the filter pack and column and stored in a collector flask for exact determination of sampled volume. Three test sites were equipped in each of two Norwegian fjords: Orkdalsfjord (abranch of Trondheimsfjord) along the central Atlantic coast, and the Sorfjord branch of Hardangerfjord about 300 km to the south. Both fjords are point sources of heavy metals loading from metallurgic industries located in the innermost part of the fjord. Averages were obtained for dissolved and particularate heavy metal content at various sites. Zinc, lead, cadmium and mercury showed differences in the proportion of dissolved to particularate fractions. Three species of tested diatoms gave systematic growth responses to heavy metal pollution in the moderately polluted Sorfjord. One alga died and one showed reduced growth rate at the more contaminated site compared with those at less polluted sites, while the most tolerant alga was apparently not affected. Only the most tolerant alga survived in the more heavily polluted fjord, showing decreasing growth rate with increasing pollution. Uptake of heavy metals increased generally with increasing metal content. (Harris-Wisconsin)
W80-03800

PREDICTION OF THE QUALITY OF WATER IN A PROPOSED IMPOUNDMENT IN SOUTHWESTERN WISCONSIN, USA,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W80-03801

SEASONAL OCCURRENCE AND VARIATION IN STANDING CROP OF A DRIFT ALGAL COMMUNITY IN THE INDIAN RIVER, FLORIDA,
Harbor Branch Foundation, Inc., Fort Pierce, FL.
M. C. Benz, N. J. Eiseman, and E. E. Gallaher.
Botanica Marina, Vol 22, No 7, p 413-420, October 1979. 6 Fig, 4 Tab, 16 Ref.

Descriptors: *Standing crops, *Seasonal, *Algae, *Indian River(FL), *Distribution patterns, *Aquatic drift, *Biological communities, *Marsh plants, *Estuaring environments, Biomass, Distribution, Drifting(Aquatic), Regression analysis, Speciation, Variability, Water temperature, Light intensity, Statistical methods, Statistics, Mathematical studies, Salinity, Estuaries, Florida, Grassed waterways.

Observations of a 50 ha seagrass flat near Fort Pierce Inlet on the Indian River, Florida September 1975-August 1976, show highest biomass (12 g dwt/sq m) in spring when water temperatures are 23-27C; light energy 400-500 Langleys/D; and salinity 33-34 ppt. Biomass variation corresponds well to variations in temperature, salinity and light, declining in mid-fall then rising in mid-winter and continuing to increase until onset of the rainy season in May. Biomass remains low during summer when temperature and light energy are highest. Species numbers are highest in September and May and lowest in October and July. Sixty-three species, including epiphytes, were identified: 3 Cyanophyta (5%), 12 Chlorophyta (19%), 9 Phaeophyta (14%), and 39 Rhodophyta (62%). The most common species are Dictoyota dichotoma, Acanthophora specifera, Hypnea cervicornis, H. musciformis and Spyridia filamentosa. Seasonal dominants include brown alga Rosenvingea intricata and red alga Chondria tenuissima. Algal biomass frequency distributions are contagious in September and January - May, suggesting aggregated populations. Little or no drift algae is found in a large number of samples in winter-spring months. In September when biomass is relatively high, contagion is highly significant due to dominance of one species, Acanthophora specifera. Low randomness values in other months suggest distributional regularity. From October to December biomass values decline; all species are present with nearly equal weight and low density, indicating low rendomness. (Danovich-Wisconsin)
W80-03803

TEMPERATURE EFFECTS ON STEADY-STATE GROWTH, PHOSPHORUS UPTAKE, AND THE CHEMICAL COMPOSITION OF A MARINE PHYTOPLANKTER,
Woods Hole Oceanographic Institution, MA.
J. C. Goldman.
Microbial Ecology, Vol 5, No 3, p 153-166, 1979. 6 Fig, 1 Tab, 34 Ref.

Descriptors: *Kinetics, *Nutrient requirements, *Phosphorus, *Temperature, *Chrysophyta, *Growth rates, *Nutrient flux models, Nutrients, Phytoplankton, Monochrysis lutheri, Algae, Cytological studies, Nitrogen, Carbon, Cycling nutrients, Equations, Limiting factors, Laboratory tests, Cultures, Monod equation.

Continuous culture experiments on the marine chrysophyte Monochrysis lutheri under phosphorus limitation in 15-23C temperatures show that phytoplankton growth and limiting-nutrient uptake rates are only synchronous at or near optimum temperature. Temperature effects on nutrient uptake rates are species specific and extremely complicate. Therefore, temperature should not be included as a variable in nutrient flux models. The Arrhenius equation well describes the response of phytoplankton maximum growth rates to temperature. Temperature effects on cell quota and steady-state phosphorus uptake rates during phosphorus limitation are much more complicated than similar effects on growth rates. M. lutheri growth and uptake are synchronous between 18.8 and 23C; however, a doubling in phosphorus cell quota at 15C leads to a significant uncoupling between growth and assimilation processes. While phosphorus uptake rate on a cell basis increases dramatically at 15C, turnover rates of total available phosphorus are unaffected by temperature. If the specific growth rate is constant at 0.20/d, phosphorus nutrient uptakes rates are 0.005-0.006 pg P/cell d between 18.8-23C, but are 0.011 pg P/cell d at 15C. Carbon and nitrogen cell quotas are relatively invariant with growth rate at each temperature; uptake rates are not nearly as affected at 15C as phosphorus uptake rates. However, nitrogen uptake is accelerated at 23C which is close to optimum temperature, stripping both nitrogen and phosphorus from solution. (Danovich-Wisconsin)
W80-03804

TWO PHASES OF THE PHYTOPLANKTON COMMUNITY IN THE BAJA CALIFORNIA UPWELLING,
Instituto Investigaciones Pesqueras, Barcelona (Spain).
M. Estrada, and D. Blasco.
Limnology and Oceanography, Vol 24, No 6, p 1065-1080, November 1979. 11 Fig, 3 Tab.

Descriptors: *Phytoplankton, *Principal component analysis, *Red tide, *Marine algae, Statistical methods, MESCAL I, MESCAL II, Punta San Hipolito, Baja California, Mexico, Dinoflagellates, Salinity, Upwelling, California Current, California Undercurrent.

Principal component analysis was applied to quantitative data on 60 phytoplankton species collected during cruises of MESCAL I and MESCAL II of Punta San Hipolito, Baja California March 1972 and March-May 1973, respectively. Higher positive values of the dinoflagellate component correspond to areas of relatively low salinity and high nutrient concentrations, associated with upwelling water from below the minimum salinity core of the California Current. Diatom dominance is related to upwelling of deeper saline and high nutrient water from the California Undercurrent. Species with highest loadings in the analysis of MESCAL I data are predominantly dinoflagellates. The first principal component is related to the red tide that occupied the area during the first cruise. Gonyaulax polyedra with a correlation coefficient of 0.88 with the first principal component is the dominant species. During MESCAL II no red tide was seen, but the ordination of species according to loadings is indicated in the presence of red tide. Loadings of the second principal component of MESCAL II are similar to loadings of the first principal component of MESCAL I, suggesting that these components can be jointly considered and represent a persistent pattern in phytoplankton composition. Distribution of the dinoflagellate bloom component shows patterns very similar to that of salinity. (Harris-Wisconsin)
W80-03805

PHOTOSYNTHESIS IN THE AQUATIC MACROPHYTE EGERIA DENSA. III GAS EXCHANGE STUDIES,
Auckland Univ. (New Zealand). Dept. of Botany.
J. A. Browse, F. I. Dromgoole, and J. M. A. Brown.
Australian Journal of Plant Physiology, Vol 6, No 4, p 499-512, August 1979. 6 Fig, 2 Tab, 43 Ref.

Descriptors: *Photosynthesis, *Absorption, *Egeria densa, *Infrared gas analysis, Analytical techniques, Submerged plants, Bicarbonates, Carbon dioxide, Inorganic compounds, Aquatic plants, Gases, Resistance, Kinetics, Cytological studies, Macrophytes, Gas chromatography, Biochemistry.

Infrared gas analysis techniques were used to study inorganic carbon uptake by Egeria densa. The CO2 response of photosynthesis in this plant is analyzed in terms of the resistance concept used in terrestial plant studies; the extent to which becarbonate ions contribute to photosynthesis is also assessed. Data for photosynthesis at various free CO2 concentrations and 4.5 pH show that carbon fixation by E. densa is saturated only at very high free CO2 concentrations (about 400 um), corresponding to 1% CO2 in the gas phase. Carboxylation and mesophyll resistances, 3800 s/m and 9000 s/m, respectively, in E. Densa are considerably higher than in aerial plant leaves. The boundary layer is the highest component (greater than 27,000 s/m) of total resistance. Closed and open-circuit gas exchange experiments demonstrate that bicarbonate is taken up by plant cells and does not act merely as an inorganic carbon reservoir for CO2 production at the plasmalemma. Bicarbonate stimulation activates photosynthesis, even when free CO2 concentration is below the CO2 compensation point. The total resistance of bicarbonate uptake is 8-12 times that of CO2 uptake, not as a result of CO2 assimilation but rather as a result of active uptake, transport and conversion of CO2 involved in bicarbonate. (Harris-Wisconsin)
W80-03806

ZOOPLANKTON IN A QUASI-STABLE PHASE IN AN ENDORHEIC LAKE (LAKE CHILWA, MALAWI),
University of the Witwaterstrand, Johannesburg (South Africa).
M. Kalk.
Hydrobiologia, Vol 66, No 1, p 7-15, September 1979. 4 Fig, 27 Ref.

Descriptors: *Zooplankton, *Lake Chilwa, Malawi, *Water level fluctuations, *Population dynamics, *Density, *Distribution, Tropodiaptomus kraepelini, Diaphanosoma excisum, Daphnia barbata, Seasonal, Dominant organisms, Water levels, Turbidity, Light penetration, Population, Speciation, Crustaceans, Filter feeders, Predation, Salinity, Algae, Plant growth.

Zooplankton density and distribution in Lake Chilwa, Malawi, was stable 1975-1976; this 700 sq km shallow endorheic lake dried up completely in 1968 and filled up again a year later. Year-around dominant species are Tropodiaptomus kraepelini and Diaphanosoma excisum, with additional dominance by Daphnia barbata during cooler dry months. These facultative feeders utilize detritus washed from the decay of Typha in surrounding swamps. Low numbers or total exclusion of other zooplankton species common in permanent African lakes, is attributed to limited quantities of green algae, submerged vascular plants, and blue-green algae which are not abundant because of prevailing high turbidity and low light penetration. Heavy fish predation of larger (>1.5 mm) zooplankton also occurs. Although a hundred-fold seasonal variation in density of zooplankton occurs, numbers stabilize in the coldest month with D. barbata compensating for loss of other dominant species. Three-fold dilution of the lake with rains and the corresponding change in salinity does not affect zooplankton density. (Harris-Wisconsin)
W80-03807

INFLUENCE OF THE SHELF-BREAK FRONT OFF NOVA SCOTIA ON PHYTOPLANKTON STANDING STOCK IN WINTER,
Dalhousie Univ., Halifax (Nova Scotia). Dept. of Oceanography.
R. O. Fournier, M. Van Det, J. S. Wilson, and N. B. Hargreaves.
Journal of the Fisheries Research Board of Canada, Vol 36, No 10, p 1228-1237, October 1979. 6 Fig, 4 Tab, 30 Ref.

Descriptors: *Phytoplankton, *Boundaries(Surfaces), *Productivity, *Continental slope, *Population dynamics, *Destratification, Nova Scotia, Turbulent boundary layers, Standing crops, Biomass, Temperature, Salinity, Chlorophyll-a, Continental shelf, Primary productivity, Mixing, Winter, Light, Light intensity, Population, Stratification.

Observations of phytoplankton in the shelf-break front off the coast of Nova Scotia were made during winters of 1977 and 1978. Chlorophyll-a in the euphotic zone correlates with the inclination of the surface front. It was concluded that the steep-

ness of the front influences the depth of phytoplankton mixing by controlling illumination received by individual cells. Two extremes of the subsurface front were apparent in experimental observations: a vertical extreme containing very little phytoplankton biomass; and horizontal extreme containing significant quantities of chlorophyll. Mathematical estimates were made on how various magnitudes of decreased frontal inclination and corresponding magnitudes of shallowing of mixed layers increase phytoplankton production. Shallowing of the mixed layer to less than 25 meters produces chlorophyll increases equivalent to that observed at 8 m. Reducing the mixed layer to 17.5 m yields the maximum rate of augmentation of new plant material. The number of 5-day intervals necessary to achieve a 25% increase in growth declines from 21 at 35 m to 6.6 at 15 m. A reduction in the depth of the mixed layer to between 15 and 20 m causes rapid increases in chlorophyll. (Harris-Wisconsin)
W80-03809

TWO ELECTIVITY INDICES FOR FEEDING WITH SPECIAL REFERENCE TO ZOOPLANKTON GRAZING,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
H. A. Vanderploeg, and D. Scavia.
Journal of the Fisheries Research Board of Canada, Vol 36, No 4, p 362-365, April 1979. 3 Fig, 11 Ref.

Descriptors: *Grazing, *Zooplankton, *Analytical techniques, *Food chains, *Food habits, Feeding rates, Indices, Mathematical models, Secondary productivity, Estimating equations, Particle size, Particle shape, Foods, Equations, Curves, Mathematical studies.

Two electivity indices which have been commonly used to quantify size-selective grazing by zooplankton are shown to be inefficient in answering two grazing-related research questions: First, are particles of certain sizes 'selected' in preference to others. Second, does this selection depend on the shape of the particle-size spectrum of the food offered. Under conditions of passive mechanical particle-size selection, these indices yield electivity vs. particle-size curves that vary with the shape of the particle-size spectrum of food offered to zooplankton. In addition to this bias, poor electivity estimates are obtained unless only a small fraction of food is eaten in such experiments. A new electivity index is recommended in place of one of the standard indices to quantify feeding zooplankton preferences; a measurement in which the new index is held constant. The new index is calculated from filtering rates or mortality rates. Not only can size selection be investigated with these indices, but also preferences based on taste or other factors. (Harris-Wisconsin)
W80-03810

SEASONAL CHANGES OF BACTERIOPLANKTON IN A RESERVOIR RELATED TO ALGAE. I. NUMBERS AND BIOMASS,
Ceskoslovenska Akademie Ved, Prague. Hydrobiologicka Lab.
V. Straskrabova, and J. Komarkova.
Internationale Revue der Gesamten Hydrobiologie, Vol 64, No 3, p 285-302, 1979. 10 Fig, 9 Tab, 33 Ref.

Descriptors: *Bacteria, *Potable water, *Klicava Reservoir, Czechoslovakia, *Biomass, *Algae, *Seasonal, *Population dynamics, Microorganisms, Reservoirs, Environmental sanitation, Impoundments, Zooplankton, Seasonal, Distribution, Organic compounds, Carbon, Biodegradation, Population, Plankton.

Samples of drinking water supply from Klicava Reservoir near Prague, Czechoslovakia were collected at ten-day intervals March-October, 1967. Changes in bacterial counts and algal biomass show a similar pattern. Four bacterial peaks occur during the season, either coinciding with algal maxima or occurring ten days later. In July, both bacterial and algal numbers decrease sharply. Average volumes of bacterial cells, corrected for shrinkage, are mostly lower than 0.2 cv micro m. The largest bacterial cell volumes and their greatest variability occur August - October. Bacteria in clusters of four or more cells account for 20% of the total count. The maximum concentration of bacterial biomass at the surface is 0.38 cv micro m/l with mean values 0.8 - 0.10 micro m/l. Bacterial carbon averages 4 - 40% of algal carbon, and about 50% of zooplankton carbon. Dissolved organic carbon is 2 - 3 times higher than that of bacterioplankton, thus suggesting resistance of most dissolved organic compounds to bacterial decomposition. (Harris-Wisconsin)
W80-03811

ANEROBIC METABOLISM OF IMMEDIATE METHANE PRECURSORS IN LAKE MENDOTA,
Wisconsin-Univ., Madison. Dept. of Bacteriology.
M. R. Winfrey, and J. G. Zeikus.
Applied and Environmental Microbiology, Vol 37, No 2, p 244-253, February, 1979. 5 Fig, 4 Tab, 36 Ref. NSF DEB 73-01511-A01 and DEB 782-4071.

Descriptors: *Methane bacteria, *Metabolism, *Lake Mendota(WI), *Limiting factors, *Anaerobic conditions, *Microbial degradation, Microbiology, Sediments, Water chemistry, Seasonal, Competition, Sediment-water interfaces, Anaerobic bacteria, Methane, Carbon dioxide, Decomposing organic matter, Degradation(Decomposition), Stratification, Turnovers, Microorganisms, Substrates.

Methanogenesis in Lake Mendota, Wisconsin sediments is limited by immediate methane precursor availability (acetate and hydrogen), by competition for these substrates by nonmethanogens, and by seasonal variations which alter sediment and water chemistry. During stratification, methanogenesis is observed in waters overlying sediments, but during turnovers, it is first detected several centimeters below the sediment-water interface. During turnover, oxygenated water is mixed throughout the water column and oxygen-sensitive methanogens are inhibited. Due to extremely small acetate pool size (3.5 micro M) in Lake Mendota, competition for this energy source between methane and acetate-oxidizing organisms may greatly affect methano-genesis. Acetate and hydrogen pool sizes are very small and turn over rapidly in sediments (0.22 for acetate). The dissolved inorganic carbon pool is large (6.4-8.3 mM) however, and turnover time is slow (111 h). In Lake Mendota sediments the rate-limiting step in methanogenesis is the rate at which hydrogen and acetate are supplied to the small methane precursor pool. Both hydrogen/carbon dioxide and acetate are simultaneously converted to methane in sediments, even with excess hydrogen or acetate present. In Lake Mendota sediments, 41% of the methane is derived from HCO3-C. Based on the assumption that CO2 and acetate alone are methane-C precursors in nature, 59% of the methane is formed from acetate. (Danovich-Wisconsin)
W80-03812

MICROBIAL METHANOGENESIS AND ACETATE METABOLISM IN A MEROMICTIC LAKE,
Wisconsin-Univ., Madison. Dept. of Bacteriology.
For primary bibliographic entry see Field 2H.
W80-03813

A NINE-YEAR STUDY OF THE PHYTOPLANKTON OF THE EUTROPHIC AND NONSTRATIFYING LOCH LEVEN (KINROSS, SCOTLAND),
Institute of Terrestial Ecology, Edinburgh (Scotland). Plankton Ecology Project Group.
A. E. Bailey-Watts.
The Journal of Ecology, Vol 66, No 3, p 741-771, November 1979. 14 Fig, 7 Tab, 90 Ref.

Descriptors: *Loch Leven, Scotland, *Eutrophication, *Phytoplankton, *Water pollution effects, *Organic loading, Nonpoint sources, Lakes, Daphnia hyalina, Zooplankton, Cyclops strenuus abyssorum, Sampling, Nitrates, Fertilizers, Oscillatoria agardhii, Chlorophyll-a, Plant populations, Distribution patterns, Density, Aquatic algae, Baseline data, Size, Phosphates.

Qualitative and quantitative changes are described which occured in phytoplankton populations of shallow, eutrophic and non-stratifying Loch Leven, located in a catchment area of 70% arable land in Scotland's Plain of Kinross with heavy loadings of nitrates from agricultural fertilizers. Sampling conducted weekly 1968-1976 showed marked seasonal and annual differences in species composition and population densities. Four trends were substantiated by the nine years of sampling: (1) Although dry weight and phytoplankton totals decreased temporarily in 1976 (coincidental with massive growth of a pale form of Oscillatoria agardhii Gomont), these two measures and chlorophyll-a concentrations all decreased over the full sampling period. (2) Dominant algae size increased and the total number of individuals producing various population maxima decreased; a 3000-fold increase in size accompanied the change toward large species which replaced nannoplankton forms. Earlier measurements of 100,000-1,000,000 individuals/ml were reduced to population maxima of 10,000/ml in later measurements. (3) The continual changes in species composition were associated with strong variations in percentage of chlorophyll-a of crop dry weight and ratios of chlorophyll-a to volume, and of dry weight to volume. (4) After 1972, phosphorus loadings were reduced approximately 1.0 g sq m/yr; the reduction is thought to be related to a shift in the zooplankton community from domination by Cyclops to domination by Daphnia. (Harris-Wisconsin)
W80-03816

CONSUMPTION OF EELGRASS, ZOSTERA MARINA, BY BIRDS AND INVERTEBRATES DURING THE GROWING SEASON IN LAKE GREVELINGEN (SW NETHERLANDS),
Delta Inst. of Hydrobiological Research, Yerseke (Netherlands).
P. H. Nienhuis, and E. T. Van Ierland.
Netherlands Journal of Sea Research, Vol 12, No 2, p 180-194, November 1978. 3 Fig, 3 Tab, 33 Ref.

Descriptors: *Food chains, *Waterfowl, *Isopods, *Eelgrass, *Coastal marshes, *Lake Grevelingen, Netherlands, Zostera marina, Brackish water, Estuarine environment, Europe, Temperate, Detritus, Aquatic plants, Primary productivity, Temperate, Birds, Foods.

Findings from a study conducted May-August 1976 in Lake Grevelingen, The Netherlands, supported hypotheses developed earlier that in temperate latitudes few animal species use eelgrass (Zostera Marina L.) as a food source; eelgrass yields only a small fraction of its production to grazing food chains and the remainder enters detritus food chains. The plant is found in temperate marine and brackish coastal waters throughout the northern hemisphere, but the Grevelingen eelgrass population is the only significant stand of this plant on the European continental coast from northern France to Denmark. Sampling shows that eelgrass provides quantifiable food amounts to five bird species (Cygnus olor, Branta bernicla, Fulica atra, Aythya ferina and Anas platyrhynchos) and one invertebrate species, the isopod Idotea chelipes. Total eelgrass consumption amounts to 0.839 g C sq m for all of Lake Grevelingen. Birds consume 23% of the total and isopods, 77%. A modest estimate is that only 3.7% of the living eelgrass production (23 g C sq m) in Lake Grevelingen is consumed by birds and Idotea. However, the actual percentage of the eelgrass eaten by these macroconsumers may be slightly larger, about 1.486 g C sq m or 6.5% of the eelgrass production. The remaining 93.5% of living eelgrass production enters the detritus chain. (Harris-Wisconsin)
W80-03819

SPECIES COMPOSITION AND SEASONAL OCCURENCE OF CENTRIC DIATOMS IN A POLLUTED MARINE ENVIRONMENT,
Karachi Univ. (Pakistan). Inst. of Marine Biology.
S. M. Saifullah, and M. Moazzam.
Pakistan Journal of Botany, Vol 10, No 1, p 53-64,

June 1978. 2 Fig, 2 Tab, 26 Ref.

Descriptors: *Karachi, Pakistan, *Diatoms, *Speciation, *Harbors, *Estuarine environments, Bioindicators, Marine microorganisms, Arabian Gulf, Indian Ocean, Lyari River, Karachi(Pakistan), Varieties, Systematics, Chaetoceros, Rhizosolenia, Coscinodiscus, Ports, Coasts, Estuaries, Intertidal areas, Seasonal, Mixing, Distribution, Spatial distribution, Temporal distribution, Lower Harbour(Karachi-Pakistan).

The richness of species diversity among marine centric diatoms in the highly polluted Lower Harbour of Karachi, Pakistan on the Arabian Sea may be accounted for by mixing in the harbor of water from the Lyari River with water from the coastal shelf. In sampling conducted April 1970 - November 1971 and October 1972 - June 1973, 101 species and six varieties belonging to 30 genera were recorded; these results compare with 25 genera, 81 species and nine varieties reported from the Pakistan shelf and the Arabian Sea in an earlier study; difference in total numbers between the two localities is thus negligible. Chaetoceros and Rhizosolenia are the most diverse genera, however, Coscinodiscus, the third most diverse genus, is represented by 13 species in the Lower Harbour but only three species in the coastal shelf. These three genera are also dominant on the west coast of India, but Coscinodiscus ranks second and Rhizosolenia third in species numbers. No relation is established between salinity and auxospore formation. Spatial distribution of diatoms in the Lower Harbour is even more irregular than temporal distribution. In addition to pollution and other environmental perturbations in the Lower Harbour, semidiurnal tides and dredging operations are also considered responsible for irregularity in diatom temporal and spatial distribution. (Harris-Wisconsin)
W80-03820

LIGHT STIMULATION OF PHOSPHATE UPTAKE IN NATURAL ASSEMBLAGES OF PHYTOPLANKTON,
Moss Landing Marine Lab., CA.
S. J. Reshkin, and G. A. Knauer.
Limnology and Oceanography, Vol 24, No 6, p 1121-1124, November 1979. 1 Fig, 1 Tab, 27 Ref.

Descriptors: *Light intensity, *Phytoplankton, *Phosphates, *Michaelis-Menten equations, *Nutrient requirements, Light, Nutrients, Kinetics, Darkness, Algae, Nitrates, Ammonia, Regression analysis, Monterey Bay(CA), Phosphorus, Nitrogen, Ecology.

Dark uptake-corrected light half-saturation constants for surface phytoplankton samples collected offshore Monterey Bay, California range 11.3-18.3% of incident light and are comparable in some instances to those found for light-dependent nitrate and ammonium uptake. Results suggest that phosphate uptake rates can be approximated by Michaelis-Menten rectangular hyperbolic function in terms of percent incident light intensity. However, it is unlikely that uptake rates for nitrogen and phosphorus are similar, since nitrogen is incorporated into phytoplankton tissue at a ratio of 16:1 relative to phosphorus. Half-saturation constants using dark bottles average 4.2% of surface light intensity; dark uptake contributes a significant amount to total uptake rates, ranging 29-33%. When dark uptake rates are subtracted from various light treatments, half-saturation constants are significantly higher, ranging 11.3%-18.3%. These average values are not unexpected; other studies have produced similar results. These observations, together with the importance of phosphorus to primary production, emphasize the ecological importance of phytoplankton being able to assimilate phosphate at relatively low light intensities. (Danovich-Wisconsin)
W80-03821

DISTRIBUTION OF BACTERIA AND CHLOROPHYLL A AT A NEARSHORE STATION IN LAKE ONTARIO,
Canada Centre for Inland Waters, Burlington (Ontario).
S. S. Rao, R. E. Kwiatkowski, and A. A. Jurkovic.
Hydrobiologia, Vol 66, No 1, p 33-39, September 1979. 3 Fig, 4 Tab, 14 Ref.

Descriptors: *Lake Ontario, *Chlorophyll, *Bacteria, *Water temperature, *Organic compounds, Regression analysis, Distribution, Organic matter, Nitrogen, Carbon, Seasonal, Speciation, Biomass, Variability, Depth, Spatial distribution, Temporal distribution, Algae.

Relationships between bacteria and chlorophyll-a seasonal distribution are related to particulate organic carbon (POC), total particulate nitrogen (TPN), and temperature in a nearshore area in Lake Ontario, studied April-November 1977; regression analysis indicates that 45-65% of the total bacterial variability is explained by POC and temperature. A relationship between high chlorophyll-a and low bacteria exists in early spring-September at which time an inverse relationship results. Diatoms are the dominant algal group during summer. In late September bacteria: chlorophyll-a ratio is 50:2 and total bacteria: POC is 35:8. High bacteria - chlorophyll-a ratio peaks in October because of declining temperatures (6C) which result in low chlorophyll-a values but high psychophilic bacterial populations. Regression analysis indicates that chlorophyll-a, POC, TPN and temperature significantly correlate to total bacterial biomass. Chlorophyll-a, POC and TPN highly correlate with one another at all depts. Temperature significantly correlates with POC and TPN only at 1 m depth, but significantly correlates with total bacteria at all depths. Total bacteria significantly correlates with chlorophyll-a and POC at 5 m and 10 m and with TPN at 10 m. Algal community composition (diatom versus non-diatom) also plays an important role in controlling bacterial biomass. (Danovich-Wisconsin)
W80-03822

SEASONAL SUCCESSION OF PHYTOPLANKTON IN A LARGE SUBARCTIC RIVER,
J. W. Moore.
Hydrobiologia, Vol 67, No 2, p 107-112, November 1979. 3 Fig, 19 Ref.

Descriptors: *Yellowknife River(Canada), Northwest Territories, Canada, *Phytoplankton, *Succession, *Subarctic, *Population dynamics, Chlamydomonas, Diatoms, Dinobryon, Light, Light intensity, Nutrients, Water temperature, Seasonal, Limiting factors, Speciation, Dominant organisms, Nitrogen, Phosphorus, Silica.

Seasonal changes in density of common phytoplankton species in the Yellowknife River of subarctic Canada are described; samples were collected every 1-2 weeks June 1975-November 1978. Initiation of the spring bloom in April is due to changing light conditions. Temperatures are constant (0C) and nutrient concentrations are both high and constant. Day length, however, was increasing rapidly (>6 min/d) and coincided with continual reduction in depth of snow and ice cover. Total phosphorus and nitrate levels decrease significantly during May-June, coincident with Chlamydomonas lapponica growth. Chlamydomonas is replaced during early summer by a rapid succession of Dinobryon species in which D. cylindricum is followed by D. sociale and in turn by D. bavaricum and D. divergens. The gradual appearance of diatoms in the river during June coincides with decreased Si02 concentrations. Thereafter, Si02 levels remain low (<0.1 g/cu m) and limit development. Dinobryon species rapidly decrease in August and September. Phytoplankton do not increase in numbers during the fall due to low temperatures and nutrient levels. Nutrient recycling does not occur until late in the season when water temperatures are 0-1C. Yellowknife River is 250 km in length. Samples were collected from the river mouth where water depth is 5-8 m and current velocity is 0-5 cm/s. (Danovich-Wisconsin)
W80-03824

MANAGEMENT OF ELODEA IN AUSTRALIAN IRRIGATION SYSTEMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
For primary bibliographic entry see Field 4A.
W80-03825

A NEW APPROACH FOR SALVINIA CONTROL,
Queensland Dept. of Lands, Brisbane (Australia).
For primary bibliographic entry see Field 4A.
W80-03827

THE USE OF MULTIPLE INVERSION AND CLEAN-FLO LAKE CLEANSER IN CONTROLLING AQUATIC PLANTS,
Clean-Flo Labs., Inc., Hopkins, MN.
For primary bibliographic entry see Field 4A.
W80-03828

ESTABLISHMENT OF WATERHYACINTH WEEVIL POPULATIONS IN LOUISIANA,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
For primary bibliographic entry see Field 4A.
W80-03829

BIOLOGICAL CONTROL OF HYDRILLA VERTICILLATA ROYLE WITH GRASS CARP (CTENOPHARYNGODON IDELLA VAL),
University of Central Florida, Orlando. Dept. of Biological Sciences.
For primary bibliographic entry see Field 4A.
W80-03830

SEASONAL VARIATION IN THE BIOMASS, TUBER DENSITY, AND PHOTOSYNTHETIC METABOLISM OF HYDRILLA IN THREE FLORIDA LAKES,
Florida Univ., Gainesville. Dept. of Botany; and Florida Univ., Gainesville. Dept. of Agronomy.
G. Bowes, A. S. Holaday, and W. T. Haller.
Journal of Aquatic Plant Management, Vol 17, p 61-65, June 1979. 1 Fig, 8 Tab, 17 Ref.

Descriptors: *Seasonal, *Jackson Lake(FL), Orange Lake(FL), *Trafford Lake(FL), *Aquatic weeds, *Plant physiology, Biomass, Aquatic plants, Metabolism, Primary productivity, Photosynthesis, Respiration, Macrophytes, Eutrophication, Carbon dioxide, Spatial distribution, Plant populations, Aquatic environment, Vegetation regrowth, Root systems, Aquatic weed control.

Lake Trafford in southern Florida has higher yearlong biomass and tuber density than Jackson and Orange Lakes in northern Florida, 1977, implying that hydrilla control may require more frequent treatments and will be more expensive in southern Florida than in northern Florida. Mats are not present in winter in northern Lakes Jackson and Orange; maximum 0.24 kg dwt/sq m mat biomass occurs in late fall. In southern Lake Trafford, mats are present year round with 0.89 kg dwt/sq m summer biomass maximum. Tuber densities peak in late fall in Lakes Jackson and Orange whereas in Lake Trafford they remain high throughout the year. Dense hydrilla mat structure, as contrasted with open water, substantially changes the aquatic environment. Light levels are reduced below the photosynthetic light compensation point 0.3m below mats, open water light levels are above the compensation point to 1.3 m depths. Hydrilla reduces mixing, allowing daytime temperatures, oxygen concentration and pH to rise to values higher than in open areas. Net hydrilla photosynthesis is lowest during winter, but increases February to May in Orange and Trafford Lakes. Seasonal variation in the C02 compensation point is large (17-90 micro l C02/l) for hydrilla in all three lakes. Values are highest in winter and lowest in spring. Such dramatic seasonal shifts in photosynthetic/ photorespiratory metabolism has not been reported with any terrestrial plants, suggesting that submersed aquatic macrophtes are a unique photosynthetic group. (Danovich-Wisconsin)
W80-03834

BRITISH COLUMBIA AQUATIC PLANT MANAGEMENT PROGRAM,

Department of the Environment, Victoria (British Columbia).
For primary bibliographic entry see Field 4A.
W80-03840

ENVIRONMENTAL QUALITY AND ECONOMIC DEVELOPMENT,
Mobil Oil Corp., New York.
For primary bibliographic entry see Field 6E.
W80-03857

COMPARATIVE BIOMASS AND GROWTH OF CYPRESS IN FLORIDA WETLANDS,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 2I.
W80-03866

COMPOSITION AND ABUNDANCE OF PHYTOPLANKTON IN TRIBUTARIES OF THE LOWER COLORADO RIVER, GRAND CANYON REGION,
Arizona State Univ., Tempe. Dept. of Botany and Microbiology.
W. M. Crayton, and M. R. Sommerfeld.
Hydrobiologia, Vol 66, No 1, p 81-93, September 1979. 2 Fig, 1 Tab, 34 Ref.

Descriptors: *Phytoplankton, *Colorado River, *Grand Canyon(AR-UT), *Baseline studies, *Physicochemical properties, Wild rivers, Rivers, Algae, Speciation, Diatoms, Sampling, Tributaries, Basic data collections, Variability, Intermittent streams, Water sources, Streams, Streamflow.

During April 1975-June 1976, physicochemical characteristeristics were analyzed and phytoplankton samples were collected at mouths of 11 tributaries of the Colorado River within the Grand Canyon. A total of 56 genera and 156 phytoplankton species were identified. Phytoplankton compositions of the tributaries are distinct; only four diatoms are common to all tributaries: Diatoma vulgare, Navicula tripuncata, Nitzschia linearis, and Synedra ulna. Abundance and variability are relatively low in all tributaries; this could reflect physicochemical changes such as the limited age of the water resulting from the short source to mouth distance, and high stream turbidity, sediment content, and current velocity. Bright Angel Creek, Shinumo Creek, and Elves Chasm exhibit the greatest species variability, while Elves Chasm and Diamond Creek have the greatest phytoplankton abundance. Several dominant algal species, Biddulphia laevis, Cocconeis pediculus, Cymbella ventricosa, Epithemia sorex, Gomphonema parvulum and Synedra ulna correlate with certain physicochemical attributes of creek water, such as temperature, pH, TDS, nitrate, calcium and potassium. (Harris-Wisconsin)
W80-03890

EFFECTS OF MINE DRAINAGE ON THE RIVER HAYLE, CORNWALL (A) FACTORS AFFECTING CONCENTRATIONS OF COPPER, ZINC AND IRON IN WATER, SEDIMENTS AND DOMINANT INVERTEBRATE FAUNA,
Cambridge Univ. (England). Dept. of Applied Biology.
B. E. Brown.
Hydrobiologia, Vol 52, No 2-3, p 221-233, February, 1977. 7 Fig, 6 Tab, 38 Ref.

Descriptors: *Water quality, *River Hayle(UK), United Kingdom, *Heavy metals, *Mine drainage, *Sediments, *Invertebrates, Cornwall, Mineral industry, Mine water, Copper, Iron, Zinc, Bioaccumulation, Benthic fauna, Environmental effects, Speciation, Biomass, Seasonal, Diptera, Larvae, Aquatic insects.

This paper describes heavy metal levels in waters, sediments and invertebrate fauna of the River Hayle, situated in the Cornwall mining district, Great Britain, 1973. Several species of Trichoptera, Odonata, Plecoptera and Diptera larvae and adult Coleoptera are present at sites above and below mining influence; however, Mollusca, Hirudinea, Oligochaeta, Crustacea and Platyhelminthes numbers are reduced at downstream sites polluted by mine drainage entry, very few invertebrate species occur. Species diversity is also reduced in the lower river. Highest metal levels are recorded in free-living Trichoptera larvae followed by Plecoptera, Odonata, Neuroptera larvae and finally adult Coleoptera. Water analysis results show that iron is the most abundant metal reaching 6 mg/l, followed by zinc (2.4 mg/l maximum) and then copper (0.7 mg/l maximum). 70% of all copper and iron is particulate whereas 80% of all zinc is soluble. Seasonal differences in total metal content suggest that metal concentrations increase during high flow and decrease during low flow. In sediments iron is the most abundant metal, followed by copper and then zinc. Copper concentrations exceed zinc in sediments probably because clay has a greater affinity for heavier divalent cations. Sediment copper concentrations increase markedly in summer. Ratios of available tc total metal present in sediments show that the sequence of exchangeable metals is Zn > Cu > Fe. (Danovich-Wisconsin)
W80-03891

EFFECT OF BENZOATE ON MICROBIAL DECOMPOSITION OF FULVIC ACIDS IN TJEUKEMEER (THE NETHERLANDS),
Institute of Limnology, Nieuwersluis (Netherlands).
For primary bibliographic entry see Field 2K.
W80-03893

ORGANOCHLORINE INSECTICIDES AND PCBS IN SEDIMENTS OF LAKE ST. CLAIR (1970 AND 1974) AND LAKE ERIE (1971),
Ontario Ministry of Agriculture and Food, Guelph. Pesticide Residue Lab.
R. Frank, M. Holdrinet, H. E. Braun, R. L. Thomas, and A. L. W. Kemp.
The Science of the Total Environment, Vol 8, p 205-227, 1977. 8 Fig, 6 Tab, 24 Ref.

Descriptors: *Sediments, *Lake St. Claire, *Lake Erie, *Insecticides, Great Lakes, Polychlorinated byphenyls, Pollutants, Organochlorine compounds, Chlorinated hydrocarbon pesticides, Organic pesticides, DDT, DDE, DDD, Pesticide residues, Water pollution sources, Distribution, Detroit River, Aldrin, Spatial distribution, Path of pollutants.

Insecticide residues are usually highest in sediments from Lake Erie's western basin and lowest in Lake St. Claire. Mean residue values in Lake St. Claire surface sediment also decreased significantly 1970-1974. In 1970, mean DDT residue was 6.6 ppb and by 1974, residues declined to 2.4 ppb. TDE was the major component of DDT residues (> 50%), followed by DDE (30%). In 1970, mean HEOD residue in Lake St. Claire was 0.1 ppb and only 24% of samples contained detectable residues. Mean PCB residues were 19 ppb in 1970 and 10 ppb in 1974. Residue spatial distribution in Lake Erie sediments show higher concentrations in basin deposits near the Detroit River and Western Basin. HEOD levels in suspended solids were 3.6 ppb in the Detroit River compared to 1.2 ppb in Lake Erie. PCBs in suspended solids of the Detroit River were 72 ppb but ranged 30-100 ppb; Lake Erie mean PCB residue was 95 ppb. Mean DDT residue in Detroit River suspended solids was 18.5 ppb; mean DDT residue in Lake Erie was 27.9 ppb. In Lake Erie, TDE was the predeominant DDT component with 18.4 ppb mean residue and values ranged 0.3-186 ppb. DDE averaged 8.2 ppb and ranged 0.2-136 ppb. Lake Erie DDT mean residues in the Western Basin were 70.3 ppb, in Sandusky Basin, 15.9 ppb and in the Eastern Basin, 30.4 ppb. With 7.6 mm/yr sedimentation rate, DDT first appeared in 1958, HEOD in 1953 and PCB in 1956; data are compatible with known usage patterns, indicating a 2-5 year lag period after widespread use began. (Danovich-Wisconsin)
W80-03894

EFFECTS OF OIL ON MARINE PHYTOPLANKTON COMMUNITIES,
Alaska Univ., Fairbanks. Inst. of Marine Science.
V. Alexander, T. Chapman, and R. A. Neve.
In: 'Alaska Fisheries: 200 Years and 200 Miles of Change', Alaska University Sea Grant Report 79-6, p 263-279, August 1979. 6 Fig, 4 Tab, 9 Ref. Proc of 29th Alaska Science Conference, held Fairbanks, Alaska 15-17 August 1978.

Descriptors: *Oil pollution, *Water pollution effects, *Phytoplankton, *Environmental effects, Baseline studies, Ecosystems, Resources development, *Outer Continental Shelf, Petroleum hydrocarbons.

A series of experiments was conducted at the Seward Marine Station of the Institute of Marine Science, University of Alaska, to determine the effects of low concentrations of petroleum hydrocarbons on marine phytoplankton. The aim was to simulate a natural bloom by using open air swimming pools with flow-through of deep nutrient-rich water pumped from Resurrection Bay and exposed to natural light. Oil was introduced in the inflow of two of three pools at rates designed to produce concentrations of 10 to 50 ppm, while a third pool remained uncontaminated as a control. Observations were designed to detect differences in photosynthesis and phytoplankton population composition between the control and oil impacted pools. Experiments were run over ten day periods. Apart from some minor suppression of photosynthesis, there were no significant changes in phytoplankton activity or population composition. The effects were considered insignificant in terms of overall ecosystem impact. This is in contrast with findings from short-term bioassay experiments in small volume containers. In general, the results support the conclusion that effects of oil spills on pelagic phytoplankton populations are likely to be trivial. (Sinha-OEIS)
W80-03895

AN OVERVIEW OF OFFSHORE ENVIRONMENTAL POLLUTION LAWS AND REGULATIONS IN CANADA, GREENLAND, AND THE NORTH SEA,
Alaska Univ., Fairbanks. Geophysical Inst.
W. M. Sackinger.
In: 'Alaska Fisheries: 200 Years and 200 Miles of Change', Alaska University Sea Grant Report 79-6, p 577-591, August 1979. 88 Ref, Proc of 29th Alaska Science Conference, held Fairbanks, Alaska, 15-17 August 1978.

Descriptors: *Oil pollution, *Legislation, *Regulation, *Arctic, *Water pollution, Canada, Alaska, Resources development, Environmental effects, Monitoring, *Outer Continental Shelf, Greenland, North Sea.

The search for offshore petroleum deposits in Arctic and sub-Arctic waters around the world has led many nations to review their legislation dealing with oil pollution incidents at sea. In some cases, legislation originally intended to deal with tanker spills and ballast discharge has been supplemented with specific measures directed at offshore drilling and production operations. Some nations have promulgated regulations which are very specific, while others have managed offshore activities by allowing administrative exceptions to very general rules, based upon an operator's proposed work plan. A brief review of pertinent provisions in the international law covering oil discharges at sea is given, followed by an outline of the framework of environmental pollution law and regulations in Canada, Greenland, and the North Sea. The governmental structure and political terms of reference within which these laws and regulations are enforced is described. Finally, some implications of these findings for the developing Alaskan Outer Continental Shelf, are included. (Sinha-OEIS)
W80-03896

THE TRANSFER OF CADMIUM FROM MARINE HETEROTROPHIC BACTERIA TO MACOMA BALTHICA,
Alaska Univ., Fairbanks. Inst. of Marine Science.
D. L. Weihs, and D. C. Burrell.
In: 'Alaska Fisheries: 200 Years and 200 Miles of Change', Alaska University Sea Grant Report 79-6, p 609-615, August 1979. 2 Fig, 1 Tab, 33 Ref.

Proc of 29th Alaska Science Conference, held Fairbanks, Alaska, 15-17 August 1978.

Descriptors: *Water pollution effects, *Cadmium, *Bacteria, *Food chains, *Environmental effects, Baseline studies, Resources development, Clams, Oil pollution, Metals, *Outer Continental Shelf, Macoma balthica.

A major portion of the renewable resources of Alaska is dependent upon clams. Apart from being themselves exploitable, clams appear to be a major food source for the commercial crabs (and also for important marine mammal species). Such trophic relationships provide relatively direct links from the sediments, which are the major repository for the potentially pollutant chemicals, to man. Marine bacteria, colonizing on the sediments and in interstial water, provide substantial nutrition for deposit feeders e.g., Macoma balthica and chemical recycling for inorganic and organic compounds. The uptake of one highly toxic metal (cadmium) by a marine heterotrophic bacterial population was found to exceed a concentration factor of 10,000. The bacteria in this situation seem to be an important mechanism for the bio-accumulation of cadmium in sediments and in organisms linked to the bacteria-sediment food chain. When cadmium-enriched bacteria were used as the sole food for the deposit feeding clam M. balthica (common to Alaskan intertidal environments), the clams also showed enrichment of the metal over the controls. The transfer efficiency in this aquaria ingestion experiment was close to one and depuration appeared to be relatively rapid. The significance of these data to the fisheries and potential pollution in Alaskan waters is discussed. (Sinha-OEIS)
W80-03897

SOURCES AND CHARACTERISTICS OF LIQUID PROCESS WASTES FROM ARCTIC OFFSHORE HYDROCARBON EXPLORATION,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
S. E. Hrudey.
Arctic, Vol 32, No 1, p 3-21, March 1979. 2 Fig, 4 Tab, 17 Ref.

Descriptors: *Water pollution, *Arctic, *Exploration, *Liquid wastes, Resources development, Environmental effects, Monitoring, Drilling fluids, Oil pollution, *Outer Continental Shelf, Hydrocarbons.

Increased interest in offshore hydrocarbon exploration in Arctic waters raises concern regarding liquid waste management from drilling operations. The typical sources of process liquid waste from exploratory drilling operations is described and data on the quantity and quality of liquid waste discharges is provided from monitoring at two offshore sites. The chemical and toxicological characteristics of the waste fluids indicate that a potential exists for water pollution in specific circumstances. However, close process control to reduce the quantities of waste fluid generated and judicious selection of drilling mud additives should prevent the occurence of significant water pollution problems from waste fluid disposal at exploratory Arctic offshore drilling operations. (Sinha-OEIS)
W80-03898

INCORPORATION, DISTRIBUTION AND FATE OF SATURATED PETROLEUM HYDROCARBONS IN SEDIMENTS FROM A CONTROLLED MARINE ECOSYSTEM,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
T. L. Wade, and J. G. Quinn.
Marine Environmental Research, Vol 3, No 1, p 15-33, January-March 1980. 5 Fig, 5 Tab, 27 Ref.

Descriptors: *Oil pollution, *Sediments, *Estuaries, *Ecosystems, Baseline studies, Water pollution effects, Environmental effects, *Outer Continental Shelf, Petroleum hydrocarbons.

A simulation of a chronic input of petroleum into an estuarine environment was investigated using the facilities at the Marine Ecosystems Research Laboratory at the University of Rhode Island. An oil-water dispersion of No. 2 fuel oil was added to the system (twice weekly for 24 weeks) and the saturated hydrocarbons from this oil were measured in suspended material and sediments. After the initial chronic oil addition, trace amounts of hydrocarbons were detected in the sediments within two weeks, but substantial accumulation was not detected for approximately 135 days. The oil appeared to enter the sediment via the suspended material, with most of the saturated hydrocarbons associated with smaller size sediment particles. With time, the fuel oil saturated hydrocarbons in the sediments were mixed to a depth of 3 to 4 cm. Although only 12% of the total saturated hydrocarbons added to the system were found in the sediments, these hydrocarbons appear to be relatively stable and were still detectable in these sediments for at least six months after the last oil addition. (Sinha-OEIS)
W80-03899

STEROLS IN NATURAL WATER AND SEDIMENT,
Texas University at Dallas, Richardson. Center for Environmental Studies.
J. P. Hassett, Jr., and G. F. Lee.
Water Research, Vol 11, No 11, p 983-989, 1977. 5 Fig, 3 Tab, 24 Ref. EPA 5T2-WP.

Descriptors: *Organic compounds, *Lake Mendota(WI), *Torch Lake(MI), *Sediments, *Water chemistry, *Lake Wingra(WI), Water analysis, Gas chromatography, Chemical reactions, Biochemistry, Sewage effluents, Organic matter, Water pollution sources, Sewage, Sewage disposal, Sedimentation, Chemistry, Runoff, Wisconsin, Michigan.

C-27, C-28 and C-29 sterols were present in sediments of lakes Mendota and Wingra, Wisconsin, and Torch Lake, Michigan, January and May, 1973. In Lake Mendota sediments, both saturated and unsaturated sterols were present, but this distinction was not made for lakes Wingra and Torch sediments. Saturated sterols indicate that sterols are being reduced; since the degree of saturation is greater in free sterols than in sterol esters, ester hydrolysis may occur more rapidly than reduction of double bonds. In Lake Mendota sediments, ester sterols account for 10% of total sterol content. Fecal sterol coprostanol is present in all samples, indicating that organic compounds from sewage are accumulating in these sediments. Sterol concentrations in Lakes Mendota and Torch water are 1000 times less than dry weight concentrations in Torch Lake sediments; therefore, sterols are accumulating in sediments. Sterol concentrations are 0.8 micro g cholestrol/l and 3 micro g beta-sitosterol/l in Lake Mindota water and 0.7 micro g cholestrol/l and 2 micro g beta-sitosterol/l in Torch Lake water. Minimum concentration in Torch Lake sediment is 3 ppm sterols on a dry weight basis. Exact identity and origin of sterols in these lakes is unknown. Algae and terrestrial runoff probably contribute most sterols; however, it is not known which source is more important. Torch Lake has received large amounts of copper mine tailings and is receiving sewage effluent. Lakes Wingra and Mendota both receive storm water drainage; Lake Mendota also receives agricultural drainage. (Danovich-Wisconsin)
W80-03900

5D. Waste Treatment Processes

NITRIFICATION-DENITRIFICATION OF WASTEWATER,
Union Carbide Corp., NY. (Assignee).
L. C. Matsch, and R. F. Drnevich.
U.S. Patent No 4,173,531, 15 p, 6 Fig, 6 Tab, 11 Ref; Official Gazette of the United States Patent Office, Vol 988, No 1, p 175, November 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Biological treatment, Sewage treatment, Activated sludge, Oxygenation, Nitrification, Denitrification, Bacteria.

This invention is practiced in the activated sludge-type system in which wastewater containing nitrogenous compounds is mixed in an oxidation zone in the presence of carbonaceous compounds with oxygen-containing gas and activated sludge containing carbon-consuming and nitrogen-oxidizing bacteria for sufficient duration to nitrify the nitrogenous compounds and form nitrified oxygenated mixed liquor which is discharged from the oxidation zone and passed to a separate zone to effect concentration of solids from liquor with at least a major part of the concentrated solids being returned to the oxidation zone as activated sludge such that the total residence time of solids (SRT) is at least two days. More specifically nitrified oxygenated liquid-solid is withdrawn to a zone in which the dissolved oxygen concentration in the liquid or liquor is below about 0.3 mg/l and preferably below about 0.2 mg/l such that nitrate and nitrate compounds are reduced to gases such as elemental nitrogen and nitrous oxide by heterotrophic denitrifying bacteria. (Sinha-OEIS)
W80-03610

METHOD FOR REMOVING SUSPENDED OIL DROPLETS FROM WATER,
Exxon Production Research Co., Houston, TX. (Assignee).
R. E. Williams.
U.S. Patent No 4,173,533, 6 p, 1 Fig, 8 Ref; Official Gazette of the United States Patent Office, Vol 988, No 1, p 176, November 6, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Oil pollution, *Separation techniques, Bubbles, Oily water, Oil wastes, Offshore platforms, Equipment, Coalescence.

Suspended droplets of oil are separated from a waste water stream by the method and apparatus of this invention. The oil and water mixture is injected into a partially submerged, vertical pipe. Gas bubbles injected into the lower end of the pipe, rise through the pipe and counter-currently contact the suspended oil droplets, thereby promoting the separation of the droplets from the waste water. The oil droplets coalesce and form a separate oil layer on top of the waste water which is readily withdrawn while clarified waste water is discharged from the lower end of the pipe. If employed to separate oil from a waste water stream on an offshore rig, the vertical pipe is submerged adjacent to the rig. (Sinha-OEIS)
W80-03647

DISINFECTION/TREATMENT OF COMBINED SEWER OVERFLOWS, SYRACUSE, NEW YORK,
O'Brien and Gere Engineers, Inc., Syracuse, NY.
F. J. Drehwing, A. J. Oliver, D. A. MacArthur, and P. E. Moffa.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-113459, Price codes: A12 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-134, August 1979. 260 p, 95 Fig, 64 Tab, 107 Ref, 7 Append. S802400(11020HFR).

Descriptors: *Combined sewers, *Storm runoff, *Waste water treatment, *Disinfection, Chlorination, Screens, Regression analysis, Mathematical models, Sewers, Sewage bacteria, Suspended solids, New York, Cost analysis, Operating costs, Water pollution sources, *Syracuse(NY).

The treatment of combined sewer overflows (CSO) at the point of overflow with the use of high-rate treatment techniques was studied at the Onondaga County Department of Drainage and Sanitation in Syracuse, New York. The high-rate techniques tested included three fine-mesh microscreening devices, and a swirl regulator/concentrator followed by disinfection by chlorine (C12) and chlorine dioxide (C102). During 1974 through 1976, 16 overflow events were monitored for the screening devices and 11 events were monitored for the swirl unit. The three microscreening units were a Sweco Wastewater Concentrator, a Zurn Micromatic, and a Crane Microstrainer with screen aperatures of 105 microns, 71 microns, and

23 microns respectively. Multiple regression analysis was used to develop mathematical performance models for the three screening devices and for the swirl regulator/concentrator relating suspended solids (SS) removal to influent hydraulic loading and influent SS concentrations. Statistically significant performance equations were developed for the C12 and C102 disinfection systems using multiple regression modeling. Results show that application of high-rate disinfection processes can result in significant reduction of bacterial concentrations in CSO. Also, the removal of SS improved this reduction of bacteria concentrations with the improvement being slightly more pronounced for C102 than for C12 disinfection. C12 disinfection, however, has the lower capital and operating costs. Special situation studies are also reported on virus inactivation, bench-scale ultraviolet light disinfection, on-line monitoring of SS, continuous monitoring of total organic carbon and chlorinated hydrocarbon analyses. (Seigler-IPA)
W80-03651

SCREENING/FLOTATION TREATMENT OF COMBINED SEWER OVERFLOWS, VOLUME II: FULL-SCALE OPERATION RACINE, WISCONSIN,
Envirex Inc., Milwaukee, WI. Environmental Sciences Div.
T. L. Meinholz, D. A. Gruber, R. A. Race, C. A. Hansen, and J. H. Moser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-130693, Price codes: A17 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-106a, August 1979. 374 p, 130 Fig, 120 Tab, 11 Ref. S800744.

Descriptors: *Combined sewers, *Storm drains, *Waste water treatment, *Storm runoff, Water pollution sources, Mathematical models, Overflow, Dissolved oxygen, Biochemical oxygen demand, Wisconsin, Coliforms, Phosphorus, Flotation, Screening, *Racine(Wis).

Three full-scale demonstration 'satellite plants' for combined sewer overflow treatment were planned, designed, constructed, operated, and monitored over a two-year period to evaluate their effectiveness as alternatives to combines sewer separation. The plants are located in Racine, Wisconsin, at major points of combined sewer overflow to the Root River. Two of the 'satellite plants' use screening/dissolved-air flotation treatment prior to overflow discharge and have a combined capacity of 22,000 cu m/day. The third plant with a capacity of 14,800 cu m/day used only screening. Permanent automatic samplers were used to collect samples of influent, screened effluent, and final effluent. These samples were analyzed for dissolved and total biochemical oxygen demand (BOD); dissolved and total organic a carbon; total, suspended (SS), and suspended volatile solids; total phosphorus; fecal coliforms; pH; and chlorine residual. Specific runs were analyzed for pesticides, particle size, the nitrogen series, chloride, and fecal streptococci. Results show that the 'satellite plants' are feasible alternatives to sewer separation. Removal efficiencies of 60 to 75% were recorded for SS and 50 to 65% for BOD. The screening method removed 50% SS and 20% BOD. Operation of the systems had a beneficial effect on the receiving waters of the Root River. Data from this area and study were also used to verify and modify the Storm Water Management Model. (Seigler-IPA)
W80-03652

COMPARISON OF OZONE CONTACTORS FOR MUNICIPAL WASTEWATER EFFLUENT DISINFECTION -- PACKED COLUMN VERSUS JET SCRUBBER,
Municipal Environmental Research Lab., Cincinnati, OH. Wastewater Research Div.
A. D. Venosa, E. J. Opatken, and M. C. Meckes.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-118789, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-098, August 1979. 92 p, 24 Fig, 40 Tab, 19 Ref, 3 Append.

Descriptors: *Ozone, *Disinfection, *Waste water treatment, Coliforms, Biochemical oxygen demand, Turbidity, Ammonia, Nitrogen compounds, Regression analysis, Suspended solids, Organic wastes, Effluents, Sewage effluents, Chlorination, Aquatic microorganisms.

The engineering and microbial parameters affecting waste water disinfection by ozonation were studied for two types of ozone contactors. The contactors tested, a jet scrubber and a packed column, were compared for ozone utilization and coliform reduction efficiency. Each contactor had a nominal design flow capacity of 75 l/min of secondary effluent. Three operation phases were used: (1) batch operation -- both contactors operated separately under identical conditions, (2) parallel operation -- both contactors operated in parallel on the same effluent, and (3) continuous operation -- both contactors operated in parallel for a three log reduction of coliforms in the same effluent. Samples were collected both before and after ozonation and were analyzed for total and fecal coliforms, temperature, chemical oxygen demand, turbidity, total organic carbon, suspended solids, ammonium nitrogen, nitrate nitrogen, nitrite nitrogen, pH, total Kjeldahl nitrogen, and others. Ozone residual was determined by amperometric techniques. Regression analysis was used to determine which factors in the effluent contributed to variations in microorganism reduction and mass transfer efficiency. Results show that a jet scrubber type contactor is not efficient for ozone disinfection primarily due to the lack of sufficient residual levels produced. The performance of both contactors was dependent on waste water effluent quality with chemical oxygen demand and organic carbon as major controlling factors. The packed column was superior to the jet scrubber in ozone utilization with the difference increasing with increasing ozone dosage. (Seigler-IPA)
W80-03653

COMBINED SEWER OVERFLOW TREATMENT BY SCREENING AND TERMINAL PONDING -- FORT WAYNE, INDIANA,
Howard, Needles, Tammen, and Bergendoff. Indianapolis, IN.
D. H. Prah, and P. L. Brunner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-11939, Price codes: A07 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-085, August 1979. 137 p, 54 Fig, 30 Tab, 5 Ref. 11020 GYU.

Descriptors: *Combined sewers, *Overflow, *Ponding, *Storm drains, *Screens, Storm water, Sewers, Sewage treatment, Sewage lagoons, Water quality, Chlorination, Water pollution, Nutrients, Chemical oxygen demand, Costs analysis, Biochemical oxygen demand, Coliforms, Indiana, Fort Wayne(Ind).

The Fort Wayne Stormwater Treatment Evaluation Project, a 75 MGD plant, was constructed in 1973-74 to study the effectiveness and costs of screening combined sewer overflows (CSO). Three types of screening techniques were tested: fixed side hill vertical screens, rotary centrifugal fine screening, and horizontal rotary drum fine screening. The benefits to receiving water by the pollutant removal effects of these screening techniques were quantified. Thirty-eight stormwater treatment events were studied. Grab samples were taken and analyzed for 14 water quality parameters including pH, temperature, settleable solids, and fecal coliforms. Results show that at the 95% confidence level, removal efficiencies for suspended solids, five-bay biochemical oxygen demand, chemical oxygen demand, and nutrients were not significantly different from zero for the screening methods tested. Also, no relationship between removal efficiency and hydraulic loading was observed. The fixed vertical-type screen had the least overall cost at $25.25/MG. Hydraulic head requirements for all screens were in the order of 2 to 10 feet static loss. A 32-acre terminal pond was capable of meeting secondary effluent standards 95% of the time even with the addition of storm-caused combined sewer overflows. Overall the treatment plant reduced the bypassing of raw untreated CSO by 82% which resulted in improvements in quality of the receiving waters. (Seigler-IPA)
W80-03656

LEVEL III: RECEIVING WATER QUALITY MODELING FOR URBAN STORMWATER MANAGEMENT,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
M. A. Medina.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-134406, Price codes: A10 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-100, August 1979. 215 p, 30 Fig, 17 Tab, 39 Ref, 2 Append.

Descriptors: *Mathematical models, *Combined sewers, *Urban runoff, *Waste water treatment, Water pollution sources, Hydrologic aspects, Computer models, Computer programs, Iowa, Dissolved oxygen, Sewage treatment, Runoff, Surface runoff, Rainfall-runoff relationships.

The development, operation, and application of a simplified continuous receiving water quality model, Level III-Receiving, are described. The model is designed to permit preliminary planning and screening of areawide urban waste water treatment alternatives for the major parameters of frequency of water quality violations and dissolved oxygen concentrations. The model can simulate the response of a stream or tidal system to the effects of waste input from upstream sources, dry weather urban sources, and wet weather urban sources. These simulations can be made for inputs from separate or combined sources. By identifying a minimum interevent time the total hours of runoff in a year are divided into storm events. Dissolved oxygen concentrations are estimated as a function of hydrodynamic and biochemical parameters. The model can be interfaced with the Hydrologic Engineering Center model, STORM, and with the continuous version of the Storm Water Management Model (SWMM). The model is not applicable to systems requiring multidimensional transient analysis and complex conditions such as eutrophication and sedimentation are not accounted for. The model was applied to the Des Moines River at Des Moines, Iowa, and results are given. Also included are STORM input data and load module job control language and a program listing. (Seigler-IPA)
W80-03657

THE DISTRIBUTION AND ECOLOGY OF THE NAIDIDAE (OLIGOCHAETA) WHICH INHABIT THE FILTER-BEDS OF SEWAGE-WORKS IN BRITAIN,
University of Wales Inst. of Science and Technology, Cardiff. Dept. of Applied Biology.
For primary bibliographic entry see Field 5C.
W80-03666

CHARACTERISTICS OF EFFLUENTS FROM GRAY AND BLACK WATER SEPTIC TANKS,
Ontario Ministry of the Environment, Ottawa.
For primary bibliographic entry see Field 5B.
W80-03791

THE EFFECT OF PHOSPHATE AND TEMPERATURE ON GROWTH OF ACTIVATED SLUDGE AND ON BIODEGRADATION OF SURFACTANTS,
Water Pollution Research Lab., Stevenage (England).
H. A. Painter, and E. F. King.
Water Research, Vol 12, No 11, p 909-915, 1978, 2 Fig, 5 Tab, 10 Ref.

Descriptors: *Temperature, *Surfactants, *Activated sludge, *Phosphorus, *Waste water treatment, *Sewage sludge, *Peptone, Phosphates, Biodegradation, Sewage, Water treatment, Sludge treatment, Lime, Sludge, Growth rates, Sewage treatment, Testing procedures, Chemical oxygen demand, Biochemical oxygen demand, Flocculation, Sewage bacteria, Bacteria.

Peptone phosphorus content variability causes most poor growth rates of non-flocculent sludge, leading to erratic and falsely low removal degrees of both chemical oxygen demand (COD) and added surfactants. Adequate phosphorus must be present in OECD/EEC synthetic sewage for proper qualitative and quantitative sludge growth and valid measurements of added surfactant removal. Phosphorus concentrations must be 2-5 mg/l in the sewage with 230-300 mg/l COD, 150-200 mg/l BOD and 98-136 mg/l TOC. Lack of phosphate also causes trouble in both units; because sludge grows in a dispersed, non-flocculent form which frequently blocks pores in WRC units, settles poorly, and causes solid losses in Husmann units. Generally, phosphorus-deficient sludges posses few bacteria types, very few attached ciliated protozoa, and no crawling ciliates. Of synthetic sewage constitutents, only peptone and meat extracts are likely to contain sufficient phosphorus to supply nutrient needs of sludge microorganisms. Addition of 5 mg P/l is recommended to ensure against phosphorus deficiency. Concentrations of 8 mg P/l give results significantly similar to those obtained with 2-3 mg P/l. Low temperatures (10C) do not affect normal sludge growth or floc formulation; the over riding factor is adequate phosphorus. Similarly, removal degrees of alkylbenzene sulphonates JNQ and TBS, and of alcohol ethoxylate, are only slightly depressed at 10C compared with those at 20C: larger effects are observed at both temperatures while phosphorus is limited. (Danovich-Wisconsin)
W80-03793

ALGAE GROWN ON WASTEWATER AS A SOURCE OF PROTEIN FOR YOUNG CHICKENS AND RATS,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
For primary bibliographic entry see Field 3C.
W80-03817

SECONDARY TOXICOLOGY AND CONTAMINANTS OF ALGAE GROWN ON WASTEWATER,
Technion-Israel Inst. of Tech., Haifa (Israel). Dept. of Food Engineering and Biotechnology.
For primary bibliographic entry see Field 3C.
W80-03818

WILL JUDICIAL ERROR ALLOW INDUSTRIAL POINT SOURCES TO AVOID BPT AND PERHAPS BAT LATER. A STORY OF GOOD INTENTIONS, BAD DICTUM, AND UGLY CONSEQUENCES,
Weston, Hurd, Fallon, Paisley, and Howley, Cleveland, OH.
For primary bibliographic entry see Field 6E.
W80-03885

5F. Water Treatment and Quality Alteration

EFFECT OF PARTICULATES ON OZONE DISINFECTION OF BACTERIA AND VIRUSES IN WATER,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
O. J. Sproul, C. E. Buck, M. A. Emerson, D. Boyce, and D. Walsh.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-116825, Price codes: A05 in paper copy, A01 in microfiche. Environmental Protection Technology Series Report No EPA-600/2-79-089, August 1979. 85 p, 7 Fig, 29 Tab, 39 Ref. R-804587.

Descriptors: *Ozone, *Water treatment, *Disinfection, *Water purification, Enteric bacteria, E. coli, Viruses, Microbiology, Turbidity, Particle size, Bentonite, Water pollution, Flocculation, Environmental engineering, Potable water.

Enteric bacteria and viruses adsorbed or incorporated into fecal material, HEp-2 cells, aluminum oxide floc and bentonite clay were subjected to ozone disinfection to determine the effect of particulates on disinfection efficiency. The organisms tested were fecal coliforms, poliovirus (Sabin Type 1), Coxsackievirus A9, porcine picornavirus type 3 (Strain ECPO-6), and f(2) bacteriophage. Particulates were tested at concentrations of 1 or 5 Nephelometric Turbidity Units. Results show that some of the test organisms were protected to differing degrees by the particulates and that the normal ozone disinfection procedures used for free organisms were not sufficient. Cell-associated poliovirus and Coxsackievirus were most protected by HEp-2 cells. Concentrations of 5.33 to 4.81 mg/l ozone were required to inactivate the cell-associated Coxsackievirus in 5 to 0 minutes. Escherichia coli, poliovirus and Coxsackievirus associated with hydrated aluminum oxide floc and bentonite clay showed little or no increased resistance to disinfection. The f(2) bacteriophage was somewhat protected by bentonite clay particles. A continuous flow disinfection apparatus was used for the tests with a bath reactor for continuous ozonation. Ozone concentrations were measured according to a slightly modified method of Schechter. (Seigler-IPA)
W80-03654

ESTIMATING WATER TREATMENT COSTS, VOLUME 4. COMPUTER USER'S MANUAL FOR RETRIEVING AND UPDATING COST DATA,
Culp/Wesner/Culp, Santa Ana, CA.
T. S. Lineck, R. C. Gumerman, and R. L. Culp.
Environmental Protection Technology Series Report No EPA-600/2-79-162d, August 1979. 86 p, 3 Fig, 6 Tab. 68-03-2516.

Descriptors: *Computer programs, *Economic analysis, *Water treatment, *Cost analysis, *Data storage and retrieval, Water supply, Construction costs, Cost comparisons, Administrative costs, Maintenance costs, Operating costs, Unit costs, Treatment facilities.

Documentation and user information for the FORTRAN computer program WATER is given. The program is designed to retrieve and update cost information for 72 large and 27 small supply systems that were previously studied to determine their construction, operation, and maintenance costs. Cost curves developed from the study are used in WATER. The program facilitates the estimation of overall treatment plant costs as well as individual process costs. Costs determined for treatment plants are input as trains of individual processes. Costs are determined by retrieving stored coefficients for a least squares polynomial fit of the cost curves and by evaluating this for the selected process design parameters. Construction costs are in terms of October 1978 dollars and can be updated by the user by two methods. A weighted composite cost index can be computed for each process or updating can be done by use of the Engineering Record Construction Cost Index. Capital costs can be determined from construction costs by applying cost factors. General contractor overhead and profit, legal, fiscal, and administrative fees, and interest can also be generated. Three data files are needed to run the program, two set up by the user and a third contained in the manual. Examples of the two user input files are given. Other information given includes program output, examples, a trouble shooting guide, and a WATER Program listing. (Seigler-IPA)
W80-03655

MANGANESE REMOVAL FROM WATER BY FLOTATION WITH MICROGAS DISPERSIONS,
Rhode Island Univ., Kingston.
F. J. DeLuise.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153117, Price codes: A02 in paper copy, A01 in microfiche. Rhode Island Water Resources Center, University of Rhode Island Completion Report (1979) 18 p, 7 Fig, 1 Tab, 11 Ref. OWRT A-067-RI (1), 14-34-0001-9042.

Descriptors: *Manganese, *Flotation, *Surfactants, *Water treatment, Methodology, Hydrogen ion concentration, *Manganese removal, Water supply.

Microgas dispersions have been used in precipitate flotation to remove manganese from dilute aqueous solutions. Various surfactants were employed in both batch and continuous operating processes, with anionic surfactants, particularly DBSS, proving the most effective for manganese removal. Final concentrations of 0.06 mg/l have been achieved consistently in the continuous countercurrent process. The effects of pH, MGD dispersion rate, and solution flow rate are presented. W80-03748

NITROGEN FIXATION BY THERMOPHILIC BLUE-GREEN ALGAE (CYANOBACTERIA): TEMPERATURE CHARACTERISTICS AND POTENTIAL USE IN BIOPHOTOLYSIS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
K. Miyamoto, P. C. Hallenbeck, and J. R. Benemann.
Applied and Environmental Microbiology, Vol 37, No 3, p 454-458, March, 1979. 8 Fig, 1 Tab, 15 Ref.

Descriptors: *Nitrogen fixation, *Temperature, *Nitrogen fixing bacteria, *Biophotolysis, Algae, Nitrogen, Bacteria, Cyanophyta, Light intensity, Oxygen, Growth rates, Animal physiology, Microorganisms, Laboratory tests, Cultures, Hydrogen, Solar energy.

Mastigocladus Laminosus NZ-86-m, thermophilic, nitrogen-fixing blue-green algae potentially useful for practical biophotolysis application, grows well in 35-50C temperature range and exhibits high acetylene reduction activity comparable to that of Anabaena species. Three M. laminosus strains were grown in modified Allen and Arnon medium. Among the strains tested, NZ-86-m showed higher specific activity; all three were similar in temperature dependency of nitrogenase activity. NZ-86-m fixes nitrogen at temperatures up to 54C with optimum nitrogen fixation occurring at 45C. Atmospheric oxygen tension is slightly inhibitory (about 20%) to this algae regardless of growth rates. A light intensity of 10,000 ergs/sq cm s is saturating. Continuous culture for two months can occur without significant contamination problems. At an increased light intensity (30,000 ergs/sq cm s), strain NZ-86-m grows exponentially to 150 Klett units before reaching light-limited, linear growth. When sparged gas is switched from air-C02 to various argon-N2-C02 mixtures, peak hydrogen evolution rates are observed. These rates are roughly proportional to algal cell density when exponentially growing cells are used. Light energy to hydrogen gas conversion efficiency is 2.7% at the highest production rate. (Danovich-Wisconsin)
W80-03796

ENVIRONMENTAL QUALITY AND ECONOMIC DEVELOPMENT,
Mobil Oil Corp., New York.
For primary bibliographic entry see Field 6E.
W80-03857

BEHAVIOR OF ABATE IN MICROORGANISMS ISOLATED FROM POLLUTED WATER,
Maryland Univ., College Park. Dept. of Entomology.
A. Daorai, and R. E. Menzer.
Archives of Environmental Contamination and Toxicology, Vol 5, No 2, p 229-240, 1977. 1 Fig, 3 Tab, 11 Ref.

Descriptors: *Water pollution, *Insecticides, *Pesticide toxicity, *Mosquitoes, Laboratory tests, Microorganisms, Toxicity, Radioactivity, Metabolism, Pesticide residues, Biodegradation, Degradation(Decomposition), Larvae, Larval growth stage, Chemical degradation, Path of pollutants, Organic matter, Denton(MD), Wye Mills(MD), Maryland.

Abate, an insecticide used to control mosquito larvae, seems less effective in polluted water and higher application rates are needed to control mosquito larvae. While some hydrolytic and oxidative degradation takes place, most Abate addaded to mosquito ponds is adsorbed by organic matter and then slowly released into the pond over longer

time periods. This investigation was undertaken to observe Abate metabolism by some microorganisms. Two sources of water were used: (1) A Denton, Maryland, sewage treatment plant, and (2) a spring-fed farm pond near Wye Mills, Maryland. Greater radioactivity occurred after extraction in the Denton sewage sample, which might indicate hydrolic metabolism. However, differences are probably due to effects of organic materials on Abate's solubility and extractability rather than to effects on its metabolism. Microorganisms isolated from polluted water are able to degrade Abate to a small degree. The selective isolate, Pseudomonas sp, breaks down Abate into water-soluble compounds and converts Abate into highly polar metabolites. However, amounts of degradation or metabolites produced are not sufficient to explain Abate's reduced effectiveness under these conditions, rather Abate has an apparent affinity for organic matter. This affinity is helpful in explaining mosquito larvae toxicity at very low concentrations. If Abate concentrates on mosquito larvae or on microorganisms which are fed upon by larvae, then the effective concentration near larvae is very high. (Danovich-Wisconsin)
W80-03892

5G. Water Quality Control

RIVER-QUALITY ASSESSMENTS.
For primary bibliographic entry see Field 5B.
W80-03606

RIVER-QUALITY ASSESSMENT--A RATIONAL SCIENTIFIC BASIS FOR POLLUTION CONTROL AND WATER-QUALITY MANAGEMENT,
C. J. Velz.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 3-10, 1978. 5 Ref.

Descriptors: *Water quality, *Water management(Applied), *Water pollution control, *River basins, Water treatment, Streams, Low-flow augmentation, Self-purification, Droughts, Tertiary treatment, Waste water treatment, Legislation, Federal Water Pollution Control Act, River-quality assessment.

Achievement of desirable river quality at acceptable costs requires that management decisions be based on sound impact assessments in each basin, not on arbitrary decisions applied on a blanket national scale. Major aspects considered in the paper are: why the Geological Survey undertook River-Quality Assessments (RQA); definition of rational RQA and other concepts; consideration of viable alternative strategies in water-quality management; and discussion of contrasts between rational-scientific approach and the current arbitrary-legalistic procedure under P.L. 92-500. Rational RQA is problem oriented. Each river basin has its unique problems and solutions, depending upon its hydrologic setting and man's use of the resources. The distinguishing element of rational RQA is that, since true cause-effect relationships are defined and verified from intensive investigations and synoptic river sampling, a scientific basis is provided for evaluating impacts on river quality by which various plans of action can be judged. In considering strategies, emphasis is given to all viable alternatives, including stream self-purification, low streamflow augmentation, and the limitations of wastewater treatment. In contrast, P.L. 92-500 is dominantly federalistic, legalistic, and arbitrary. Congress overreacted to Executive Branch abuses and to explosive pressures from new ecology groups. Basic changes in the law are in order. (See also W80-03606) (Humphreys-ISWS)
W80-03607

ON THE VALUE OF SOIL COLUMNS FOR ASSESSING THE TRANSPORT PATTERN OF VIRUSES THROUGH SOILS: A CRITICAL OUTLOOK,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 5B.
W80-03622

CONTRIBUTIONS OF URBAN LAND USE TO STREAM WATER QUALITY,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-03644

METHOD FOR REMOVING SUSPENDED OIL DROPLETS FROM WATER,
Exxon Production Research Co., Houston, TX. (Assignee).
For primary bibliographic entry see Field 5D.
W80-03647

LEVEL III: RECEIVING WATER QUALITY MODELING FOR URBAN STORMWATER MANAGEMENT,
Duke Univ., Durham, NC. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W80-03657

LIABILITY FOR OIL POLLUTION - UNITED STATES LAW,
Glassie, Pewett, Beebe and Shanks, Washington, DC.
For primary bibliographic entry see Field 6E.
W80-03667

A REVIEW OF NEW COLORADO WATER AND AIR POLLUTION LEGISLATION,
For primary bibliographic entry see Field 6E.
W80-03668

DETERMINANTS OF WATER QUALITY IN AGRICULTURAL WATERSHEDS,
Illinois Univ. at Urbana-Champaign. Dept. of Ecology, Ethology, and Evolution.
I. J. Schlosser, and J. R. Karr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153604, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Center, University of Illinois Research Report No 147. January, 1980. 81 p, 29 Fig, 1 Tab, 39 Ref, 3 Append. OWRT A-093-ILL(1).

Descriptors: *Agricultural watersheds, *Channel morphology, *Nonpoint pollution, *Riparian plants, *Suspended solids, Illinois, *Water quality, Phosphorus streams, Turbidity, Model studies, Rainfall-runoff relationships.

Water quality was monitored for 17 months in six different agricultural watersheds in east central Illinois to evaluate the impact of alterations in riparian vegetation and channel morphology. Sampling was conducted during both base flow and runoff periods. The results indicate that the relevant theory for enhancement of water resources and for modelling water quality in agricultural watersheds varies depending on flow conditions. During base flow, emphasis should be placed on linking hydrological theory of instream transport of inorganic material to biological theory of production and transport of organic material. Peak levels of all parameters are reached during the summer period of increased biotic activity. Concentrations of suspended solids remain relatively constant, and seasonal dynamics of phosphorus and turbidity appear to be controlled by leaf inputs in fall. During runoff events, a simple model based on the KLS factors of the Universal Soil Loss Equation accurately predicts spatial patterns of suspended solids, turbidity, and phophorus levels in watersheds with a uniform channelized stream well protected stream banks, and cultivation to the stream edge. The model was not an accurate predictor where heterogeneity in riparian vegetation and channel morphology existed. Suspended solids concentrations were greater than predicted in areas where unstable (fine) substates occur and potential energy of the stream is high due to removal of riparian vegetation and creation of a uniform and straight channel.
W80-03709

BEHAVIOR OF ABATE IN MICROORGANISMS ISOLATED FROM POLLUTED WATER,
Maryland Univ., College Park. Dept. of Entomology.
For primary bibliographic entry see Field 5F.
W80-03892

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE ANTICIPATED DECISION INFLUENCE PERIOD IN REAL TIME RESERVOIR OPERATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
L. A. W. Anderberg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151301, Price codes: A04 in paper copy, A01 in microfiche. PhD Dissertation, 1979. 50 p, 9 Fig, 13 Ref. OWRT B-195-COLO(1), 14-34-0001-9060.

Descriptors: *Reservoir operation model, *Reservoir release decisions, Reservoir release policy, *Reservoir storage, Reservoir yield, Optimum hydropower production, Power production, Hydroelectric power, Water supply, *Reservoir operation, Decision making.

A reservoir is a physical mechanism that provides a potential to turn an unreliable source of water into a dependable water supply system. A set of rules and the reservoir operator's skill and experience are supposed to utilize the potential of the reservoir such that the predetermined objectives of the sytem are carried out in the most beneficial way. The rules for operation should ideally trade off immediate benefits against future benefits to be expected such that both the needed assurance of water and/or power is provided for and the potential of the reservoir is utilized most efficiently. Present practice in reservoir operation provides the assurance implicitly by means of the Critical Period, but has no explicit mechanism to improve the efficiency of operation. In order to be able to employ a mechanism to trade off immediate benefits against expected future benefits, a time frame over which the total benefits intermediate decisions and their associated risks can be explicitly evaluated has to be recognized. This dissertation presents a logic for such a time frame, called the Anticipated Decision Influence Period, ADIP. Within this context an analysis and discussing of responsive and flexible reservoir operation rules to guide the operator in the decision-making process. It is suggested that currently used Rules Curves can be favorably substituted by Operational Equations in order to enhance flexibility.
W80-03645

AN INTERACTIVE RIVER BASIN WATER MANAGEMENT MODEL: SYNTHESIS AND APPLICATION,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
J. M. Shafer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153547, Price codes: A10 in paper copy, A01 in microfiche. Colorado Water Resources Research Institute, Colorado State University Technical Report No 18, August 1979. 246 p, 42 Fig, 36 Tab, 58 Ref, 5 Append. OWRT A-039-COLO(3), 14-34-0001-8006.

Descriptors: *Simulation, *Water supply, River basins, Network analysis, *Interbasin water transfers, Streamflow, Reservoir storage, Water management, Water conveyance, Computers models, Model studies, Gache la Poudre River.

A computer model is presented for quantifying the impacts of multipurpose water management policy. the model is designed for the analysis of water availabilities throughout a river basin over extended time periods. It is capable of simulating the monthly storage, flow, and diversion of water in a

complex river basin system. The prototype system is represented in the model by a network of interconnected nodes which characterize the reservoirs, tributary inflow points, and diversion points in the basin. Linkages between nodes represent the conveyance morphology of the basin. The model, MODSIM, is synthesized from previously existing models. A base or core model is selected from these models, and further modified so as to better conform to the attributes and capabilities considered desirable for the model. An advantage of the model is its optimizing capability with respect to reservoir operating rules. Also, MODSIM is able to simulate institutional dictates governing water allocation, such as water rights priorities. Conveyance losses and return flows resulting from irrigation practices can also be considered by MODSIM. MODSIM is interfaced with an interactive conversational data management package. Conversational programming facilitates the rapid analysis of management alternatives, and promotes the successful transfer of this technology to water planners and managers with little background in computer programming. Two case studies are presented which demonstrate the utility of MODSIM for aiding in the analysis of impacts of long-term changes in water resource management within a river basin. The Cache la Poudre River Basin in north-central Colorado is used for both case studies.
W80-03708

GEOPHYSICAL AND HYDROLOGIC PREDICTION OF FISSURING AND LAND SUBSIDENCE, SOUTH-CENTRAL ARIZONA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
J. K. Boling, M. C. Carpenter, and S. N. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151434, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Project Partial Completion Report, January 1980. 43 p, 11 Fig, 46 Ref, 3 Append. OWRT A-073-ARIZ(2), 14-34-0001-7005, 7006 & 8003.

Descriptors: *Fissures(Geologic), *Land subsidence, Movement, Forecasting, *Arizona, Structural geology, Pumping, Groundwater, Drawdown, Measurement, Dial gauges, Signal peak(Ariz), Picacho Mountains(Ariz), Avra Valley(Ariz).

Bimonthly horizontal strain measurements of fissures have been made at 7 dial gages near Signal Peak, Picacho Mountains, and in Avra Valley, AZ. A Pyrex glass rod is fixed on one side of a fissure and pushes against a dial gauge fixed to the other side. Installations are in shallow covered trenches. Movements ranging from 5 mm to 25 mm are detected with a measurement error of less than 5 mm. Fissures have been observed to open and close repeatedly. With one exception, old and new cracks showed no pronounced difference in character. The max. opening rate was 4.1 mm hr-1 over a 17-day period, and the max. closing rate was 5.0 mm hr-1 over a 14-day period. Following a severe storm, one fissure abruptly opened 31 mm within a 14-hour period while one nearby parallel fissure opened 1.6 mm and another nearby parallel fissure closed 2.1 mm. Transducer measurements of horizontal movements across fissures of up to 4 hours' duration were made with a resolution of 10 nm. Simultaneous measurements of horizontal linear strain in nearby unfissured soils provided controls. In Avra Valley, the greatest rate of fissure closing was 8.7 um hr-1 across a span of 95 cm, while the control installation exhibited a compressive strain rate of 2.3 x10-6 hr-1. The greatest rate of fissure opening was 3.8 um hr-1 over an 86 cm span while the control dilated 0.43 x 10-6 hr-1. At a breached section of McMicken Dam, the greatest opening and closing rates were 6.0 um hr-1 and 10 um hr-1 over a 76 cm span. At both locations, the fissure movement and control strain were mostly in the same sense and the movement was smooth. Correlation of fissure movement, rainfall, pumping and water level fluctuations indicates major earth fissure movements will occur after high pumping rates during or shortly after large storms. Long term records will form the data base for predictive models of subsidence and earth fissuring.
W80-03710

STANDARDS, OPTIMALITY AND RESILIENCE IN WATER-RESOURCE MANAGEMENT,
Harvard Univ., Cambridge. Div. of Applied Sciences.
M. B. Fiering, J. J. Harrington, and P. P. Rogers.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-153240, Price codes: A25 in paper copy, A01 in microfiche. Final Report to Office of Water Research and Technology, December 1978. 491 p, 73 Fig, 68 Tab, 129 Ref, 1 Append. OWRT C-7095 (No 6208)(2), 14-34-0001-6208.

Descriptors: *Water resources development, *Planning, *Investment, *Institutions, *Probability, Reservoirs, Economics, Water quality control, Flood control, Political aspects, Water supply, Flood frequency, Resilience, Robust statistics, Technological uncertainty, Optimal design, Model complexity, Institutions, Nearly optimal decisions, Connecticut River.

Three parallel threads are studied. One introduces system resilience into assessment of water-resource projects. It takes specific account of the time - dependent response of water-resource systems to major changes in supply, demand and extreme events. The notions of time-to-failure and time-between-failures are introduced. A new density function, the Wakeby, is introduced for flood frequency analysis; it is shown to have important properties of robustness. A calculus for decision-making under uncertain technology is shown to lead to resilient decisions. The second thread emphasizes institutional resilience by noting that problems have an optimal complexity associated with their size (i.e., the numbers of variables and of constraints) and with institutional considerations which promulgate near-optimal solutions as useful alternatives to global optima (which might be only marginally superior in terms of the stated objective function). The third portion is a systematic appraisal of optimal and near-optimal solutions to systems of modest size, with emphasis on strategies for capacity expansion. It is shown that many near-optimal solutions are often very close to the global optimum, frequently within the error attributed to noise in the parameters of the optimum. The axiom that optimality should always be sought is shown to be indefensible. An example is run on a model river basin.
W80-03750

A TECHNIQUE FOR ESTIMATING HEIGHTS REACHED BY THE 100-YEAR FLOOD ON UNREGULATED, NONTIDAL STREAMS IN NORTH CAROLINA,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 2E.
W80-03764

SELECTED HYDROLOGIC DATA FOR SPOKANE VALLEY, SPOKANE, WASHINGTON, 1977-78,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W80-03769

MULTINATIONAL CORPORATIONS, NATION-STATES AND OCEAN RESOURCE MANAGEMENT: THE IMPACT OF THE WORLD'S 200-MILE ECONOMIC ZONE ON MULTINATIONAL AND NATIONAL DEVELOPMENT,
Hawaii Univ., Honolulu. Coll. of Tropical Agriculture.
For primary bibliographic entry see Field 6E.
W80-03859

SPATIAL ASPECTS OF THE PRESSURE FOR SHORELINE DEVELOPMENT: THE EXAMPLE OF PUGET SOUND,
Ottawa Univ. (Ontario). Dept. of Geography and Regional Planning.
For primary bibliographic entry see Field 6E.
W80-03884

6B. Evaluation Process

RIVER-QUALITY ASSESSMENT: CONCEPT, FRAMEWORK, AND APPLICATION IN THE WILLAMETTE RIVER BASIN, OREGON,
Geological Survey, Portland, OR.
D. A. Rickert.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 11-21, 1978. 2 Fig, 18 Ref.

Descriptors: *Water quality, *River basins, *Oregon, *Decision making, Planning, Programs, Management, Project purposes, Analytical techniques, Mathematical models, Water pollution, Pollutants, Dissolved oxygen, Metals, Assessments, Priorities, Hydrology, Forecasting, *Willamette River Basin(OR), Assessment framework, River-quality assessment.

The U.S. Geological Survey recently (1976) completed an intensive river-quality assessment in the Willamette River basin, Oregon. The major objectives were to (1) define a practical framework for conducting river-quality assessments that will provide a sound technical basis for decision makers to use in evaluating planning and management alternatives, and (2) apply the framework to assess existing or potential river-quality problems of the Willamette River basin. The most noteworthy finding of the assessment was that across-the-board advanced waste treatment is not the answer to the problem of meeting stringent water-quality standards established for the Willamette River. The implication of this finding is that rigid nationwide standards and regulations are likely to result in unneeded expenditures in some river basins and in unachieved standards in others. The assessment also found that existing water-quality data collected under monitoring- and surveillance-type programs are inadequate for defining the critical cause-effect relationships that control river-quality problems. Intensive, synoptic surveys specifically designed to assess local problems and conditions are required to provide an adequate information base for making key management decisions. Perhaps the three most important questions that need to be asked at the beginning of each study are: (1) Have the relevant problems been delineated. (2) What types and intensities of data collection are needed to provide a technically sound assessment. (3) How much time is needed to provide information that is adequate for decision making. The ultimate success of resource assessment is largely determined by its initial formulation. Careful answers to these questions, together with thoroughly defined objectives, will provide a sound start to each new assessment. (See also W80-03606) (Humphreys-ISWS)
W80-03608

RESIDUALS MANAGEMENT: A TOOL IN RIVER-QUALITY ASSESSMENT APPLIED TO COAL DEVELOPMENT IN THE YAMPA RIVER BASIN, COLORADO,
Geological Survey, Reston, VA.
R. M. Hirsch, I. C. James, II, and J. E. Schefter.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 142-164, 1978. 3 Fig, 7 Tab, 17 Ref, 1 Append.

Descriptors: *River basins, *Colorado, *Long-term planning, *Model studies, *Regional analysis, Planning, Water utilization, Coals, Costs, Economics, Industrial plants, Consumptive use, Management, Thermal powerplants, Resources development, *Yampa River Basin(CO), Coal development, Plant-level models, Regional models, Coal gasification, Electric power generation.

Residuals management provides a basis for projecting the effects of economic development on the discharge of residuals to the environment and on the use of water. It is a useful technique of river-quality assessment for basins wherein substantial

economic growth is either occurring or expected. Residuals management techniques were utilized to assess the effects of coal development and utilization in the Colorado part of the Yampa River basin. Plant-level models were used to describe the material and energy balances and the operating costs of surface mining of coal, the Synthane process of coal gasification, coal-fired thermal-electric generation of power transportation of coal by coal-slurry pipeline, and transportation by unit train. As part of the model of electric power generation, four alternative methods of cooling are considered: once-through cooling, cooling ponds, wet cooling towers, and dry cooling towers. Each of these models provides estimates of water withdrawal, water consumption, and residuals generated directly by the particular process involved. An economic input/output model of the study was used to predict the total growth of the regional economy under four coal-development scenarios. The amount of coal assumed to be mined is constant across all of these, but each of them assumes a different use of the 'new' coal: gasification, electric power generation, coal-slurry pipeline export, or unit train export. The plant-level models are linked with the input/output model to provide estimates of total (direct and indirect) water use and residuals generation in the regional economy under the four scenarios. (See also W80-03606) (Humphreys-ISWS)
W80-03616

A CULTURAL RESOURCE SURVEY OF THE TETON REPLACEMENT FARMLAND, JEFFERSON COUNTY, IDAHO,
Commonwealth Associates Inc., Jackson, MI.
J. G. Franzen.
Final Investigative Report No R-2092, Volume I, submitted to USDI Water and Power Resources Service, January 1980. 70 p, 2 Fig, 4 Tab, 33 Ref, 2 Append.

Descriptors: *Idaho, *Archaeology, *Dating, *Agriculture, *Flood damage, Surveys, History, Land use, Farms, Irrigation practices, Sands, Silts, Arid lands, Teton Dam(Idaho).

An intensive survey was conducted to evaluate the historic and cultural properties of 3200 acres of land along Idaho State Route 33 that is to be sold to farmers as replacement farmland for lands damaged by flood waters when the Teton Dam failed. The area is located on the Snake River Plain and is part of the Columbia Intermontane Physiographic Province. Dunes of sand and silt dominate the topography of the area. The land is semi-arid (7.5 in/year rainfall), has low humidity, a large temperature range, and large yearly variations in seasonal conditions. For the survey parallel transects were walked over the entire area at approximately 30 meter intervals. Test excavations were performed at three sites where subsurface deposits were indicated and all soil was screened through 1/4 inch hardware cloth. The survey located 25 archeological sites and 56 isolated artifact finds. Of these 22 sites with chipped stone tools, debitage, and faunal materials were dated to the pre-historic period. These prehistoric sites may be related to the procurement and processing of bison, antelope, or grass seeds. Site descriptions are given for each of the 25 archeological resource areas. Due to the destructive nature of planned irrigated agriculture in the area a program of mitigation is recommended for controlled surface collection and functional-spacial analysis. (Seigler-IPA)
W80-03778

EFFECTS OF MECHANICAL CUTTING ON SUBMERSED VEGETATION IN A LOUISIANA LAKE,
Louisiana Dept. of Wildlife and Fisheries, Baton Rouge.
For primary bibliographic entry see Field 4A.
W80-03832

STREAM TYPES IN IDAHO: AN APPROACH TO CLASSIFICATION OF STREAMS IN NATURAL AREAS,
Idaho Univ., Moscow. Dept. of Biological Sciences.
N. L. Savage, and F. W. Rabe.
Biological Conservation, Vol 15, No 4, p 301-315, June, 1979. 5 Fig, 6 Tab, 23 Ref. OWRT A-046-IDA(3).

Descriptors: *Streams, *Classification, *Idaho, Gradient, Flow characteristics, Substrate, Wetlands, Aquatic plants, Aquatic animals, Aquatic habitat, Biological communities, Physical properties.

A preliminary classification for unaltered low order streams in Idaho consists of ephemeral streams, which contain water only during periods of high runoff; spring streams, formed where groundwater aquifers discharge as surface springs; and three types of permanent streams. Key features used to designate stream type are order, gradient, pattern of flow, and substrate--all of which are readily identifiable, nonvariable characteristics. Type designation is supported on an ecological basis by analysis of extensive collections of aquatic plants and invertebrates. (Howard-Mass)
W80-03835

FORMULATING AQUATIC WEED MANAGEMENT PROGRAMS,
Commonwealth Scientific and Industrial Research Organization, Griffith (Australia). Div. of Irrigation Research.
For primary bibliographic entry see Field 4A.
W80-03841

TECHNICAL AND ECONOMIC ASSESSMENT OF SOLAR DISTILLATION FOR LARGE SCALE PRODUCTION IN FRESH WATER.
Bechtel Corp., San Francisco, CA. Research and Engineering.
For primary bibliographic entry see Field 3A.
W80-03842

IMPACTS OF THE WESTERN DROUGHT ON THE REGIONAL ELECTRICITY SITUATION.
For primary bibliographic entry see Field 6D.
W80-03843

CHESAPEAKE BAY FUTURE CONDITIONS REPORT. APPENDIX 3. ECONOMIC AND SOCIAL PROFILE.
Baltimore District, U.S. Army Corps of Engineers, Baltimore, Maryland, Corps of Engineers, Baltimore, MD. Baltimore District.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 473, Price codes: A14 in paper copy, A01 in microfiche. Interim report, December 1977. 296 p, 27 Fig, 143 Tab.

Descriptors: *Regional economics, *Regional analysis, *Chesapeake Bay, *Forecasting, *Social aspects, Regional development, Water requirements, Economic impact, Economic prediction, Economics, Regions, Human population, Urbanization, Land use, Recreation, Water demand, Navigable waters, Water pollution sources, Water supply, Waste water treatment, Growth rates.

As one of 16 supporting appendices to the second part of a three-phase comprehensive study of Chesapeake Bay, the present document provides an economic and social history of the region, describes population characteristics, analyzes the main economic standard industrial classification sectors, and derives economic and demographic projections through standardized models developed for sub-national areas. Chesapeake Bay Region, heavily urbanized today, forms the southern portion of the Boston-Washington megalopolis considered widely to be the economic center of the U.S. With a population that has doubled since 1940 to about 8 million, the Bay region is expected to double in population growth once again by 2020, with more than 50% of this projected to take place in the Washington D.C. subregion. Almost 3.3 million persons were employed in the Bay region in 1970, with 6.8 million projected by 2020. Although less than 10% of the land is developed, nearly 80% of the population live in urban areas. Land use is characterized by: (1) increasing industrial demands for processing and cooling water; (2) water-based recreational facilities and opportunities outstripped by booming demand; (3) adverse impacts brought about by expansion of navigational facilities to keep pace with economic expansion; (4) continued pollution and sedimentation of region waterways as a result of construction, industrial effluents, storm runoff and municipal discharges; and (5) shortage of adequate water supply and waste treatment facilities. (Harris-Wisconsin)
W80-03844

ESTIMATING WILLINGNESS TO PAY: WHY AND HOW.,
Stockholm Univ. (Sweden).
P. Bohm.
Scandinavian Journal of Economics, Vol 81, No 2, p 142-153, 1979. 1 Fig, 14 Ref.

Descriptors: *Demand, *Willingness-to-pay, *Estimating, *Decision making, *Social aspects, *Political aspects, Economics, Public sector, Estimating equations, Curves, Theoretical analysis, Social change, Social values, Social needs, Governments, Economic impact, Risks, Analytical techniques, Political constraints, Institutional constraints.

Demand-revealing methods for public goods must meet minimum standards of intelligibility and quality control in order for experiments and other applications of direct decision making in society to be acceptable to government. If standards are not met, politicians and ordinary people will not be convinced that public choice by direct, demand-revealing methods represents an improvement over previous choice methods. Demand-revealing methods are relevant whenever government cannot reach a well-founded decision, that is, in highly controversial cases or in cases involving important matters of principle. Demand-revealing methods should not be used in everyday political decision making. Economic incentives may or may not influence responses with respect to issues of high moral content. Uncertainty basically remains as to whether economic incentives will dominate or be dominated by other incentives. It is important to look for demand-revealing mechanisms with no incentives for misrepresenting preferences. Judgements must be made regarding whether bias is absent in a particular application, not only in principle but also in a laboratory setting. (Danovich-Wisconsin)
W80-03846

HEDONIC PRICES, PROPERTY VALUES AND MEASURING ENVIRONMENTAL BENEFITS: A SURVEY OF THE ISSUES.
Bowdoin Coll., Brunswick, ME.
A. M. Freeman, III.
Scandinavian Journal of Economics, Vol 81, No 2, p 154-173, 1979. 3 Fig, 37 Ref.

Descriptors: *Benefits, *Prices, *Theoretical analysis, *Analytical techniques, *Property values, Economics, Demand, Willingness to pay, Curves, Environment, Equilibrium prices, Mathematical models, Utility, Supply, Equations, Air pollution, Cities.

Hedonic price techniques for estimating benefits work about as well or as poorly as any empirical technique for estimating economic functions. Hedonic technique assessment involves substantial simplification and abstraction from complex reality. Assumptions are never completely realized in practice. Criticisms raised against these techniques can be raised against any economic empirical work: data are inadequate: variables are measured with error; and variable definitions seldom correspond precisely to theoretical constructs. This paper reviews the theoretical basis and assumptions of hedonic price equations derived from property value data to obtain prices and inverse demand functions for environmental amenities such as air quality. Review involves two separate and conceptionally distinct steps: using the hedonic price equation to estimate marginal implicit characteristic prices, and using these implicit prices to estimate inverse demand functions or marginal willingness to pay functions for household groups. Results from more than a dozen studies assessing

air, water quality and urban noise problems, indicate the model has substantial explanatory power with respect to housing prices. (Danovich-Wisconsin)
W80-03847

WHAT CAN WE GET FROM EFFLUENT CHARGES,
C. S. Russell.
Policy Analysis, Vol 5, No 2, p 155-180, Spring, 1979. 1 Tab.

Descriptors: *Effluents, *Pollution taxes(Charges), *Economic efficiency, *Policy, Economics, Political aspects, Regulation, Federal government, Discharge(Water), Water quality standards, Marginal costs, Benefits, Economic growth, Technology, Taxes, Decision making, Environment.

This paper discusses effluent charges as environmental policy instruments and advocates trading effluent charges efficiency for a simpler system, retaining dynamic incentive effects that are the major positive attributes of charges. Statically efficient charges are information-intensive and most vulnerable to litigation delays. If charges are viewed as policy targets, static efficiency is not meaningful. If charge levels are set by Congress, political considerations are central to levels chosen and little is gained by legal challenges. If charge levels are chosen by The U.S. Environmental Protection Agency, information is required to justify technical decisions. Political pressure and bargaining are important at every stage; legal challenges may involve successful delays in implementation. Over the long-run, any charge system spurs firms and public bodies to search for better and cheaper ways to avoid discharging pollution into air and water. A realistic and potentially useful policy would be to combine part of the existing regulatory apparatus with nationally uniform effluent charges covering all significant pollutants. In addition, all discharges would be subject to national effluent charges, creating continuing incentives for developing and adopting environment-saving innovations. This policy is roughly consistent with the charges-as-targets position; such a course would not produce economic efficiency in the static sense of minimum pollution expenditures for attained ambient quality levels. (Danovich-Wisconsin)
W80-03849

FINANCIAL STATEMENT MODELING: ANALYZING THE POLLUTION-CONTROL TAX INCENTIVE,
L. A. Nikolai, R. Elam, and B. Bozeman.
Policy Analysis, Vol 5, No 2, p 243-254, Spring, 1979. 2 Fig, 3 Tab.

Descriptors: *Policy, *Pollution taxes(Charges), *Financial feasibility, *Investment, Mathematical models, Economics, Statistical methods, Statistics, Taxes, Pollution abatement, Legislation, Regulation, Tax rates, Depreciation, Amortization, Capital, Industries, Cost-benefit analysis, Economic justification.

Financial statement modeling, used to evaluate congressionally mandated pollution-control tax incentives, concludes that such tax incentives are ineffective. On an investment of $900,000, the maximum total present value tax savings amounts to less than $60,000 for a manufacturing firm investing in a facility with a 26-year life. The Internal Revenue Code includes provisions for investment credit, bonus depreciation, and certified pollution control facility accelerated amortizations to stimulate capital expenditures. Financial statement modeling is an approach to policy analysis which employs financial data and evaluates alternatives in terms similar to cost-benefit analysis, but financial statement modeling is rooted in concepts used by accountants rather than economists. It is a useful modification of cost-benefit analysis and yields sufficiently different results. Current tax provisions are ineffective for several reasons: (1) Due to rapidly improving pollution control technology, firms given a choice between comparable short and long-term alternatives usually opt for the short-term facility. (2) Allowable asset time spans for selected high environmental impact industries are less than those necessary to make tax incentives financially attractive. (3) Tax deductions are not sufficient to justify trying to get facilities certified by the appropriate pollution control agency. (4) Tax provisions tend to discriminate against extractive firms. (Danovich-Wisconsin)
W80-03850

THE ANALYSIS OF RISK IN IRRIGATION PROJECTS IN DEVELOPING COUNTRIES,
University of East Anglia, Norwich (England). School of Developmental Studies.
I. Livingstone, and A. Hazlewood.
Oxford Bulletin of Economic and Statistics, Vol 41, No 1, p 21-35, February, 1979. 4 Fig, 1 Tab.

Descriptors: *Economics, *Irrigation, *Developing countries, *Water supply, *Risks, *Economic efficiency, *Optimization, Water resources, Equations, Curves, Water shortage, Water management(Applied), Agriculture, Irrigation design, Irrigation systems, Irrigation water, Irrigation efficiency, Marginal utility, Capital, Investment, Social aspects.

Fluctuating water availability is an issue which arises in planning irrigation schemes in developing countries due to differences in rainfall. A recognized rule-of-thumb in engineering practices recommends that the volume of water assumed for planning purposes should be available in four years out of five. Only in one year out of five will water be insufficient for installed capacity. Such a rule provides an optimal solution only in particular circumstances and its general application is inconsistent with standard net present value criterion for evaluating alternative investment projects. These rules should be determined, not on technical, but on economic and social grounds. A large mechanized farm may not accept frequent serious water deficiency, involving large financial losses. However, it is different for village irrigation with peasant production. If peasant farmers are poor with low incomes and food supply, they attach high values to extra output, even if available only in better years. Denying cultivators the full benefits of high river flow years so as to reduce risks of doing relatively worse in other years is not important. If crop storing is possible, a larger area could produce extra food in good years to be used as a reserve against subsequent crop failure. Therefore, the optimum solution shows that peasant farmers may follow a less cautious policy than a large mechanized farm. (Danovich-Wisconsin)
W80-03851

ENVIRONMENTAL PROTECTION FOR WHOM,
Hampshire Coll., Amherst, MA. Dept. of Political Science.
S. P. Shapiro.
Social Policy, Vol 10, No 1, p 24-28, May-June 1979. 23 Ref.

Descriptors: *Environment, *Political aspects, *Leadership, *Psychological aspects, *Pollution abatement, Political constraints, Natural resources, Economics, Employment opportunities, Under-employment, Welfare(Economics), Social participation, Social aspects, Water policy, Water resources development, Income distribution, Conservation, Decision making.

Resource conservation and environmental protection are commonly perceived as elitist movements with leadership made up of wealthy primitivists and other persons unconnected to and unconcerned with the basic needs and concerns of most of the working class of the United States. A paradox is that environmentalism has been a highly divisive issue, driving a wedge between the often tenous alliance of labor and middle-class liberals and excluding those for whom pollution poses the greatest threat: the urban working poor, miners, etc. At the same time, environmental policy is also seen as a 'safe' issue--unlikely to upset or even challenge the existing political and economic structures within the United States. Its concern is mainly for those with the least interest in any major change in American society. Forgetting that any justification for less growth is necessarily a justification for existing levels of inequality in this country, many Americans find themselves caught between two apparently impossible extremes on environmental issues. First, success of the movement may be costly in terms of jobs and economic well-being so as to cause a severe backlash; and hard-core environmentalists readily take on an elitist cast, as their myopia about social conditions at times suggests more concern with aesthetics than people and jobs. Second, the environmental movement provides industry with potential political allies of organized labor and the poor, in its struggle against more effective environmental legislation. (Harris-Wisconsin)
W80-03853

ADAPTIVE ECONOMICS AND NATURAL RESOURCES POLICY,
University of Southern California, Los Angeles. Dept. of Economics.
R. H. Day.
American Journal of Agricultural Economics, Vol 60, No 2, p 276-283, May 1978. 29 Ref.

Descriptors: *Economics, *Natural resources, *Decision making, *Adaptation, Federal project policy, Water allocation(Policy), Water distribution(Policy), Water policy, Administration, Management, Economic justification, Methodology, Optimization, Equilibrium, Environmental effects, Planning, Behavior, Economic efficiency, Systems analysis.

An approach to economics differing sharply from (but closely related and complimentary to) optimality and general equilibrium theory is presented which has special relevance to natural resources policy. Adaptive economics is based on the following postulates of human behavior: (1) Economic activity changes the environment in which further activity is conceived and executed: results of this activity, such as resource exhaustion or irreversible environmental effects, may be far more consequential than the setting in which it takes place. (2) Economizing is carried out by agents who are partially informed, have limited memory and computational powers, and who make only imperfect forecasts of the effects of their choices. (3) Current knowledge derives from only past system operation. (4) Economic activity, including planning, takes time; delays interfere with plans, actions and consequences. (5) Plans and behavior are imperfectly coordinated, so that economic behavior takes place out of equilibrium. Adaptive economics is primarily a study of how economies shift in disequilibrium and secondarily whether or not, and if so, how equilibria or adaptedness states are achieved. Adaptive models will produce surprises in the evolution of economic activity whose exact timing and magnitude defy prediction. Instead of focusing on economic efficiency, natural resources policy should be aimed at preparing for surprises and not on predicting them--perhaps a contradiction in terms. What is needed is slack: surplus resources, redundancies, expectation of less than maximal growth, operational delays, and procedural mistakes. (Harris-Wisconsin)
W80-03854

ENVIRONMENTAL MANAGEMENT IN GENERAL EQUILIBRIUM: A NEW INCENTIVE COMPATIBLE APPROACH,
Mannheim Univ. (Germany, F.R.).
R. Pethig.
International Economic Review, Vol 20, No 1, p 1-27, February 1979. 2 Fig, 23 Ref.

Descriptors: *Economics, *Environment, *Resource management, *Pollutants, *Mathematics, Mathematical models, Production, Equations, Equilibrium, Theoretical analysis, Curves, Mathematical studies, Optimization, Governments, Resource allocation, Competition, Welfare(Economics).

Main results of applying the Groves-Ledyard mechanism to environmental management are an existence theorem of competitive equilibrium relative to incentive-compatible environmental management and two Fundamental Welfare Theorems for pollution economy. The Groves-Ledyard con-

struction does not address or resolve some major informational problems involved with pollution; its main purpose is to elicit correct information on consumer preferences. Environmental management is studied only in a static general equilibrium model. Firms and consumers produce private goods, some of them being undesired by-products. Residual waste products are defined as private goods in aggregate excess supply, a satisfactory micro-economic basis for explaining pollution. A central part of the model is the pollution function which is viewed as the economy's production function for public goods. If spatial and temporal interpretation of commodity space is adopted, pollution function knowledge is an important informational problem in environmental economics. Consumers are concerned only about pollution levels and not about residual allocations which lead to these levels; therefore, only government has complete information on the pollution function. However, knowledge of the pollution function does not exhaust Groves-Ledyard mechanism informational feasibility with environmental management issues. (Danovich-Wisconsin)
W80-03855

SYSTEMS ECOLOGY, PEOPLE ECOLOGY, AND THE ANTHROPOLOGY OF FISHING COMMUNITIES,
Rutgers - The State Univ., New Brunswick, NJ. Dept. of Human Ecology and Social Sciences.
B. J. McCay.
Human Ecology, Vol 6, No 4, p 397-422, December 1978. 2 Tab, 98 Ref.

Descriptors: *Commercial fishing, *Economics, *Social impact, *Anthropology, *Social adjustment, *Behavior, Fisheries, Marine fisheries, International waters, Fogo Island, Newfoundland, Canada, Social aspects, Social change, Social needs, Social values, Employment, Social mobility, Ecology, Political aspects, Employment opportunities, Under-employment, Unemployment, Adaptation, Fish management, Systems analysis.

Data from research among fishermen of Fogo Island, New foundland are used to explore 'people ecology', an alternative to marine anthropology which emphasizes people in place of systems as starting points for study, and underscores the role of larger political and social processes which affect local fishermen. During a period of local fishery decline, two general adaptive strategies were observed among Fogo Islanders. Diversification as one strategy involved broadening alternatives both within fishing and between fishing and other modes of making a living. This adaptive strategy appears to have been the most general and traditional approach, and characterized responses to individuals and households to a fisheries decline in the early 1960s. However, as environmental and economic problems continued and worsened, many people began to adjust in ways which involved intensification of response: going on welfare, becoming wage laborers, leaving the island, or dropping their independent status to team up in larger boats to remain in commercial fishing. However, the shift from diversification to intensification strategies on Fogo Island cannot be viewed simply in relation to the local natural environment. Similarly observed shifts from individual to group units of purposive action was simulated by the involvement of 'outsiders' in local matters and made possible by the structural dependency of small Newfoundland outport communites on the Canadian government. (Harris-Wisconsin)
W80-03860

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

GUIDELINES FOR SOCIOECONOMIC IMPACT ANALYSES OF ENVIRONMENTAL REGULATIONS,
North Carolina State Univ. at Raleigh. Dept. of Economics and Business.
D. Hargett.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149263, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research Institute of The University of North Carolina, Raleigh, Rpt No 149, Dec 1979. 68 p, 15 Fig, 7 Tab. OWRT A-101-NC(2), 14-34-0001-8035.

Descriptors: *Cost-benefit analysis, *Regulations, *Decision-making criteria, Net present value, Internal rate of return, Water quality, Recreation, Flood control, Welfare maximization, Sensitivity analysis, *Water utilization, Cost-benefit, *North Carolina, Socio-economic impact analysis, Decision-making, Criteria, Economics, Water resources.

This report presents a brief description of socioeconomic impact analyses for noneconomists. Emphasis is given to the concept of economic efficiency or to the use of socioeconomic or benefit-cost analysis to enhance state and national income. Economists have not been very successful at conveying their ideas concerning benefit-cost analysis to noneconomists. One reason is a lack of consensus among economists on certain aspects. Aspects of benefit-cost analysis that are particularly troublesome for noneconomists are stressed. Some of these include: marginal analysis of welfare maximization, normalized pricing, estimations of willingness to pay, economics of information, and the social rate of discount. Examples are briefly described, and references are offered to several publications that have had the same purpose. (Kiger-NC)
W80-03602

ESTIMATING WATER TREATMENT COSTS, VOLUME 4. COMPUTER USER'S MANUAL FOR RETRIEVING AND UPDATING COST DATA,
Culp/Wesner/Culp, Santa Ana, CA.
For primary bibliographic entry see Field 5F.
W80-03655

A BIOECONOMIC MODEL OF THE GULF OF MEXICO SHRIMP FISHERY,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
For primary bibliographic entry see Field 8I.
W80-03845

ESTIMATING WILLINGNESS TO PAY: WHY AND HOW.,
Stockholm Univ. (Sweden).
For primary bibliographic entry see Field 6B.
W80-03846

HEDONIC PRICES, PROPERTY VALUES AND MEASURING ENVIRONMENTAL BENEFITS: A SURVEY OF THE ISSUES,
Bowdoin Coll., Brunswick, ME.
For primary bibliographic entry see Field 6B.
W80-03847

PIGOVIAN TAXES, POLLUTER SUBSIDIES, REGULATION, AND THE SIZE OF A POLLUTING INDUSTRY,
York Univ., Downsview (Ontario).
For primary bibliographic entry see Field 6E.
W80-03848

FISHERMEN'S REMUNERATION SYSTEMS AND IMPLICATIONS FOR FISHERIES DEVELOPMENT,
Rhode Island Univ., Kingston.
J. G. Sutinen.
Scottish Journal of Political Economy, Vol 26, No 2, p 147-162, June 1979. 2 Fig, 1 Tab, 11 Ref.

Descriptors: *Commercial fishing, *Income distribution, *Risks, *Theoretical analysis, *Resources development, Economics, Fishing, Income, Equations, Investment, Labor, Capital, Employment, Wages, Payment, Fish harvest, Mathematical models, Competition, Water resources development, Fisheries.

Theoretical economic analysis demonstrates that the share system of remuneration makes a significant contribution to fishing industry development. This paper describes conditions under which the share system of remuneration is preferred by relevant parties in the fishing industry and examines implications for fisheries development. The theory argues that competitive labor markets set the level of welfare for marginal fishermen; they are neither better nor worse off under any other remuneration system. Also, if share systems are abolished and replaced by wage systems, the total number of fishermen and their individual incomes would decline. Fishing entrepreneurs are better off with the share system. It allows spreading some risk among the crew, thus reducing risk-bearing costs and providing work incentives which makes it less costly to extract desired work from the crew. Since unit costs are lower under share systems, output and input utilization levels should be greater than under wage or remuneration systems. An entrepreneur's incentive to invest is not mitigated as long as competitive markets prevail. Competitive markets allow for changes in remuneration arrangements to accomodate new capital equipment additions. Changes can involve the fixed payment, share, or both. (Danovich-Wisconsin)
W80-03858

6D. Water Demand

RESIDUALS MANAGEMENT: A TOOL IN RIVER-QUALITY ASSESSMENT APPLIED TO COAL DEVELOPMENT IN THE YAMPA RIVER BASIN, COLORADO,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 6B.
W80-03616

AN EVALUATION OF MARGINAL WATERS AS A NATURAL RESOURCE IN ISRAEL,
Technion-Israel Inst. of Tech., Haifa. Faculty of Agricultural Engineering.
For primary bibliographic entry see Field 3C.
W80-03742

IMPACTS OF THE WESTERN DROUGHT ON THE REGIONAL ELECTRICITY SITUATION.
Available from the National Technical Information Service, Springfield, VA 22161 as FEA-G-77-360, Price codes: A08 in paper copy, A01 in microfiche. Joint Staff Report: Federal Power Commission and Federal Energy Administration, September 30, 1977. 81 p, 2 Fig, 10 Tab, 8 Append.

Descriptors: *Droughts, *Hydroelectric power, *Pacific Northwest U.S., *Water conservation, *Water policy, *Long term planning, Regulation, Hydrologic budget, Low flow, Rationing(Water), Water shortage, Hydroelectric plants, Pacific Coast region, Idaho, Oregon, California, Washington, Canada, Water distribution(Applied), Water management(Applied), Regional analysis, Regional development.

Drought conditions during winter 1976-77 decreased the ability of some hydroelectric plants in the Pacific Northwest to produce sufficient electric energy; effects are especially notable in the area of the Northwest Power Pool (NWPP) serving parts of 14 states and western Canada, where 66.3% of winter energy is from hydroelectric facilities. Projected electrical demand and supply relationships are given. While the outlook for NWPP is dependent on precipitation during fall and winter months, it is unlikely that existing water shortfalls can be replenished although increased precipitation may alleviate problems in some subareas. Short-term recommendations include: (1) Federal and state agencies must adopt and implement strong conservation measures and continuously monitor the drought. (2) Federal drought programs should be continued year-round in NWPP. (3) Programs to minimize impacts on agriculture, fish and wildlife should take precedence over minor losses in electric generation. Long-term recommendations center generally on extended efforts to promote electric energy conservation, but other specific measures are also advised: (1) A direct current power line should be constructed between Arizona and Oregon for greater future

exchange flexibility. (2) The Bonneville Power Administration should make provision for passing on thermal costs significantly greater than usual. (3) Legislation is needed for electrical energy emergency allocations. (4) The appropriateness of increasing interconnections between eastern and western U.S. bulk power systems should be examined. (Harris-Wisconsin)
W80-03843

CHESAPEAKE BAY FUTURE CONDITIONS REPORT. APPENDIX 3. ECONOMIC AND SOCIAL PROFILE.
Baltimore District, U.S. Army Corps of Engineers, Baltimore, Maryland, Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 6B.
W80-03844

6E. Water Law and Institutions

PUBLIC WATER SUPPLIES: THE EFFECT OF FEDERAL AND TENNESSEE WATER RESOURCE LAW,
East Tennessee State Univ., Johnson City.
V. A. Sikora.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-149271, Price codes: A05 in paper copy, A01 in microfiche. Water Resources Research center, University of Tennessee, Knoxville, Research Report No 72, December 1979. 87 p, 6 Tab, Append. OWRT A-055-TENN(1), 14-34-0001-9045.

Descriptors: *Water law, *Water rights, Riparian rights, Common law, Judicial decisions, Water policy, Water supply, *Tennessee, *Federal-State water rights conflicts, Eminent domain.

The water law in Tennessee was determined by a legal evaluation of Tennessee statutes and cases as they affect Tennessee's water supplies. Once the existing law was determined, it was evaluated for its effect upon securing adequate water supplies for public water systems. The opinions of public water suppliers were obtained by means of a questionnaire which was mailed to all Tennessee public water suppliers. The study has determined, first, under both common law and Tennessee statute public water suppliers have nearly the same ability as other persons to acquire water rights. In addition, public water suppliers have ample eminent domain power delegated to them to acquire property and water rights. Second, public water suppliers under Tennessee riparian doctrine appear to have a priority over other withdrawers from a watercourse. In conflicts between withdrawal uses and instream uses both parties seem to be required to follow the correlative rights doctrine except for navigational uses which seem to dominate all other uses, including withdrawal uses. Third, public water suppliers favor a state water resource management program operated by a public health agency. Most suppliers saw a decline in the reliability of their primary water source in the next 20 years. Fourth, the Tennessee court cases on water law are 50-100 years old and based on problems in a culture which no longer exists. There are many substantial and significant gaps in the case law which could be filled by appropriate legislation. And finally, federal law and agencies have a pervasive, though not exclusive, roll in management of water in Tennessee.
W80-03601

RIVER-QUALITY ASSESSMENT--A RATIONAL SCIENTIFIC BASIS FOR POLLUTION CONTROL AND WATER-QUALITY MANAGEMENT,
For primary bibliographic entry see Field 5G.
W80-03607

LIABILITY FOR OIL POLLUTION - UNITED STATES LAW,
Glassie, Pewett, Beebe and Shanks, Washington, DC.
A. I. Mendelsohn, and E. R. Fidell.
Journal of Maritime Law and Commerce, Vol 10, No 4, p 475-496, July 1979.

Descriptors: *Oil pollution, *Oil spills, *Federal Water Pollution Control Act, *Water pollution control, Environmental effects, Water law, Federal government, Legal aspects, Oil industry, Oceans.

Few areas of law are as complex as that governing liability for oil pollution. The subject involves principles of tort law, largely judge-made admiralty doctrines, legislative enactments, and international conventions. The interplay of federal and state law provides further complexity. Perhaps the greatest difficulty may be the lack of comprehensive federal legislation. There are several federal statutes that are relevant to oil pollution liability. The 1851 Limitation of Liability Act dealt with the general liability of shipowners. The 1972 Federal Water Pollution Control Act Amendments pertained to water pollution in general and included the regulation of oil pollutant discharges. The 1973 Trans-Alaska Pipeline Authorization Act allowed private parties to recover for oil pollution damage. Various other acts since 1973 have dealt with specific aspects of oil pollution control. New broader legislation has been proposed in Congress. Current American law attempts to reconcile the diverse interests in oil pollution liability. Comprehensive legislation is probably the best method to achieve that aim. (Wilson-Florida)
W80-03667

A REVIEW OF NEW COLORADO WATER AND AIR POLLUTION LEGISLATION,
J. Bermingham, and J. Raisch.
The Colorado Lawyer, Vol 2, No 11, p 1-10, September 1973.

Descriptors: *Colorado, *Water quality control, *Sewage disposal, Legislation, Legal aspects, Water law, Pollutants, Water pollution, Environmental control, Sewage, Water quality act.

The 1973 Colorado General Assembly passed a number of environmental bills, some of which have significant and sweeping impact. The Water Quality Act (WQA) was adopted with two goals in mind: (1) to improve existing water pollution legislation; and (2) to comply with the requirements of the 1972 Federal Water Pollution Control Act Amendments. The WQA provides for a Water Quality Control Commission with powers to adopt control regulations and to promulgate water quality standards and waste discharge permit regulations. The administration and enforcement functions have been transferred to the Division of Administration of the Department of Health. House Bill 1553, The Individual Sewage Disposal Systems Act (ISDSA), authorizes the establishment, administration and enforcement of minimum standards, rules and regulations for individual sewage disposal systems. The ISDSA details minimum standards for systems which must be included in all local or state rules and regulations. The General Assembly also introduced amendments to the Colorado Air Pollution Act. Senate Bill 393 dealt with control of pollution from motor vehicles. (Wilson-Florida)
W80-03668

AMERICAN BAR ASSOCIATION RESOLUTION RE NATURAL RESOURCES OF THE SEA ADOPTED BY THE HOUSE OF DELEGATES, AUGUST 6, 1973 AND REPORT OF THE SECTION OF NATURAL RESOURCES LAW RECOMMENDING ADOPTION OF THE RESOLUTION.
American Bar Association, Washington, DC. Natural Resources Section.
Natural Resources Lawyer, Vol 6, No 4, p 589-633, Fall 1973.

Descriptors: *Resource allocation, *International law, *Water resources development, Water law, Resources, Resource development, International waters, International joint commission, Water resources, United Nations.

In response to and in anticipation of United Nations conferences on the law of the sea, the American Bar Association (ABA) passed this resolution, stating its position regarding natural resources of the sea. The resolution addresses: (1) the allocation of seabed resources of the continental margin and those outside the margin; (2) fishing interests; (3) protection of the environment; (4) the need for unimpeded navigation and transportation; (5) assurance of investment integrity; (6) scientific research; and (7) determination of disputes. Accompanying the resolution is a report which traces the history of United Nations actions regarding the law of the sea, particularly the attempts to create an international regime for the exploration and exploitation of seabed resources beyond the limits of national jurisdictions. The major points of the ABA resolution and their historical backgrounds are developed. The most important components of an equitable regime are set forth: The selection of the governing body and the role of the regime. Consideration is given to reasonable and secure investment conditions, to the President's Statement on United States Oceans Policy of May 23, 1970, and to the question of the number of treaties necessary. (Swanson-Florida)
W80-03695

THE ECONOMIC CONSEQUENCES OF ALLOCATING GROUNDWATER TO COMPETING INTEREST IN THE SANTA CRUZ BASIN, PIMA COUNTY, ARIZONA,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
J. C. Wade, and A. H. Griffin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-151483, Price codes: A03 in paper copy, A01 in microfiche. Water Resources Research Center, University of Arizona, Project Completion Report, February 26, 1980. 22 p, 1 Fig, 33 Ref, OWRT A-087-ARIZ(3), 14-34-0001-9003.

Descriptors: *Economics, *Aquifer management, *Water rights, *Water user, *Legal aspects, Indian reservations, Water supply, Arizona, Pima County(Ariz), *Tucson Basin, Indian water rights, Papago Tribe.

The groundwater in the Tucson Basin is being drawn faster than it is replenished by nature. The water table is falling, giving rise to several conflicts between water users in the Basin. Several lawsuits are in progress, including an action by the Papago Tribe against some of the major water users in the Basin. Largely because of these difficulties, the State Legislature has established a commission to make proposals for the reform of Arizona's groundwater law. The pattern of water use in the Basin will undoubtedly be changed by the outcome of the present litigation and the coming reform of Arizona's groundwater law. This report gives a short summary of a research project which has studied how water use in the Basin might be affected by changes in the availability of water. The report also gives an account of the effects that these changes in water use could have on the region's economy. The report concludes that the water problems of the Tucson Basin will have little effect on the region at large and that these problems are simply a matter for the Indians and the other water users in the Basin to sort out amongst themselves.
W80-03707

COPPER MINING FROM UNDER LAKE SUPERIOR: THE LEGAL ASPECTS,
F. M. Tuerkheimer.
Natural Resources Lawyer, Vol 7, No 1, p 137-155, Winter 1974.

Descriptors: *Michigan, *Lake Superior, *Mining, Great Lakes, Legislation, Mineral industry, Water pollution, Boundaries, Treaties, Legal aspects, Copper.

Detailed geological studies of the Lake Superior Basin have revealed the high probability of rich copper deposits. Three sets of laws are directly relevant to the exploitation of such copper deposits: (1) international law as reflected in the 1903 Boundary Waters Treaty; (2) United States law as reflected in the 1899 Refuse Act; and (3) state law as reflected in Michigan statutes. Boundary waters,

as defined by the U.S.-Canada treaty, include any body of water through which the international boundary runs. Thus, Lake Superior is subject to Article IV of the treaty which states that boundary waters shall not be polluted. U.S. law is applicable in that Lake Superior is navigable waterbody. The 1899 Refuse Act requires Army Chief of Engineers authorization to build a structure such as a mining platform, in navigable waters. Michigan law makes it unlawful to remove minerals from under the Great Lakes without a lease from the Department of Natural Resources. The long-standing policy of the Department has been to refuse leases for mining operations that involve shafting or rigging. (Wilson-Florida)
W80-03759

THE FEDERAL RESERVED RIGHTS DOCTRINE - FROM 1866 THROUGH EAGLE COUNTY,
Debevoise and Liberman, Washington, DC.
J. C. Muys.
Natural Resources Lawyer, Vol 8, No 2, p 221-235, 1975.

Descriptors: *Federal-state water rights conflict, *Constitutional law, *Federal jurisdiction, Federal government, State governments, Navigable waters, Navigable rivers, Indian reservations, Non-navigable waters, Federal reservations, State jurisdictions.

Regulation of water usage in the western states has been hampered by a continuing competition between the federal and state governments. The federal government claims a power base in the constitutional grants of authority from the Welfare, War and Treaty Powers, and most importantly, from the Commerce and Property Clauses of the federal Constitution. The Supreme Court has held that the Commerce Clause vested control in Congress of all navigable waters, and has enlarged that power over the years to include even control over non-navigable streams which might affect navigable ones. Thus the federal government can prevent application of state laws to 'federal' waters. Further, the navigation servitude allows the federal government to take private property rights without compensation. Under the Property Clause, the argument is that the federal government still owns those lands in the western states which it has not specifically granted to the states, and thus retains the right to regulate water use on those lands. The development of case law on these subjects is traced, including a brief discussion of the Eagle County case, a 1971 decision on federal reserved rights. (Swanson-Florida).
W80-03777

REBORN FEDERALISM IN WESTERN WATER LAW: THE NEW MELONES DAM DECISION,
R. Walston.
Hastings Law Journal, Vol 30, No 6, p 1645-1682, July 1979.

Descriptors: *California, *Federal-state water rights conflicts, *Water allocation(Policy), *Federal reclamation law, Water rights, History, Judicial decisions, Reclamation, California, Legislation, Federal government, Water law.

In many areas of law, the doctrine of federalism has been preempted by the increasing concentration of power at the national level. In water law, however, this trend has been reversed by the United States Supreme Court in California v. United States (the New Melones Dam decision). The original purpose of the 1902 Reclamation Act - in keeping with federalism - was to allow state control of water. This included the doctrine in western states and territories. As federal power expanded in this century, federal power over reclamation grew. The federal government possessed exclusive control of water stored behind federal dams. The New Melones Dam decision has stated that the states have a right to control the water in federal dams to the extent not inconsistent with specific congressional directives. The Court opted for the values of federalism. Uncertainty about the exact relationship of federal and state power can be overcome by giving presumptive correctness to state administrative policies for water allocation. (Wilson-Florida)
W80-03795

BREATHING NEW LIFE INTO SECTION 8 OF THE 1902 RECLAMATION ACT: CALIFORNIA V. UNITED STATES,
T. J. Beaton.
University of Colorado Law Review, Vol 50, No 2, p 207-229, Winter 1979.

Descriptors: *California, *Federal reclamation law, *Water allocation(Policy), *Federal-state water rights conflicts, Judicial decisions, Water rights, Irrigation, Reclamation, Legislation, Water law, Federal government.

One of the more controversial topics in Western water rights has been the relationship between federal and state policies regarding water usage. In California v. United States, the United States Supreme Court found that Section 8 of the 1902 Reclamation Act (Section 8) permitted California to impose conditions on Bureau of Reclamation water appropriation permits, if the conditions were not inconsistent with congressional directives regarding the water project. Section 8 provides that nothing shall be construed to interfere with any state laws relating to water appropriation. Previous decisions construing Section 8 have generally centered on a 'proprietary' theory of state involvement. This theory relegates state power under Section 8 to a minor role of merely defining the property interests involved. California v. United States rejects the proprietary theory and permits states to exercise control over the appropriation and distribution of water impounded by federal reclamation dams where not inconsistent with federal mandates. The issue is primarily one of Congressional intent, and could be easily clarified by Congress. (Wilson-Florida)
W80-03814

STATE CONTROL OVER FEDERAL RECLAMATION PROJECTS,
California State Water Resources Control Board, Sacramento.
W. R. Attwater.
Natural Resources Lawyer, Vol 8, No 2, p 281-295, 1975.

Descriptors: *California, *Federal-state water rights conflicts, *Judicial decisions, *Federal Reclamation Law, Reclamation, Water resources, Water allocation(Policy), State governments, Water law, Federal jurisdiction, State jurisdiction.

California and the United States (U.S.) Bureau of Reclamation have been locked in litigation regarding state authority over reclamation projects. The main issue involved is whether Section 8 of the 1902 Reclamation Act or any other federal law requires the U.S. to comply with state procedures regarding water appropriation when it seeks to acquire previously unappropriated water for project purposes. Although the Bureau's position is that it need not comply with state law regarding water appropriation, in the past, as a matter of comity, it has filed applications and participated in state administrative hearings. California law requires any person who wishes to appropriate water to apply for and receive a permit from the State Water Resources Control Board. Despite the literal language of Section 8 of the Reclamation Act, which preserves state law in reclamation, recent Supreme Court decisions have indicated other provisions of federal law may be overriding. Present reclamation procedures should be modified to meet the needs of both state and federal governments. Some modifications are suggested to the present procedure for authorization and construction of U.S. Bureau of Reclamation projects. (Wilson-Florida)
W80-03823

PIGOVIAN TAXES, POLLUTER SUBSIDIES, REGULATION, AND THE SIZE OF A POLLUTING INDUSTRY,
York Univ., Downsview (Ontario).
P. Burrows.
Canadian Journal of Economics, Vol 12, No 3, p 494-501, August, 1979. 2 Fig, 9 Ref.

Descriptors: *Pollution taxes(Charges), *Regulation, *Optimization, *Economic efficiency, *Size, Taxes, Economics, Curves, Costs, Demand, Industries, Damages, Marginal costs, Equations, Pollution abatement, Industrial wastes, Economic impact, Industrial production.

Pigovian taxes are not generally more efficient for society than other pollution control instruments and may not lead to Pareto-optimal industrial pollution levels. Either of two views may be correct, depending on damage cost curves of individual polluters: (1) Pigovian taxes may induce firms to leave industry when damages they cause do not justify this action. (2) If Pigovian taxes are set equal to marginal damage levels at Pareto-optimal pollution levels, industries will move toward their optimal pollution levels. If a large number of polluters exists in each locality, Pigovian tax leads to Pareto-optimal firm and industry output (pollution) levels; regulation does not reduce industrial pollution towards the Pareto-optimal level; and polluter subsidies perversely moves industrial pollution away from Pareto-optimization even though individual firms respond by cutting their output below Pareto-optimal levels. If small numbers of polluters exist in each locality or individual polluters face upward sloping marginal damage cost curves, Pigovian taxes are socially inefficient and too punitive while regulation/polluter subsidies are not punitive enough to induce Pareto-optimal exit of firms. Therefore, Pigovian taxes should not be used as a general standard of optimality against which to measure polluter subsidies and other polluter control instruments. (Danovich-Wisconsin)
W80-03848

FINANCIAL STATEMENT MODELING: ANALYZING THE POLLUTION-CONTROL TAX INCENTIVE,
For primary bibliographic entry see Field 6B.
W80-03850

CANADIAN-AMERICAN RELATIONS IN THE ARCTIC: THE EFFECT OF ENVIRONMENTAL INFLUENCES UPON TERRITORIAL CLAIMS,
T. M. Tynan.
The Review of Politics, Vol 41, No 3, p 402-427, July 1979.

Descriptors: *Canada, *Arctic, *United States, *International waters, *Political aspects, North America, International law, Treaties, Commercial fishing, Oil spills, Governments, Navigation, Disasters, Political constraints, Foreign waters, Northwest Passage(Canadian Arctic), Boundaries(Property).

Canadian foreign policy (1880-1970) concerning the Arctic has consistently been based upon a perception of potential threats to Canada's sovereignty and jurisdiction even when such threats never existed. A historical overview is presented to show how these perceptions may have developed. In terms of US-Canadian Arctic interactions, three phases can be discerned: (1) In the first or formative phase, Britain transferred her northern territories in the continent to Canadian control in 1880; from then until about 1940, Canadians were apprehensive that US population in these territories outnumbered those of Canadian citizenship. Canadians in fact only incrementally and tentatively exercized sovereignty rights over foreign economic interests in the territories. (2) The second phase, that of the Second World War and later construction of the Distant Early Warning (DEW) air defense facilities, was one of joint cooperation by the US and Canada; cooperation was partly due to the perception that a foreign threat, if any, came from Europe and Eurasia (Germany, then later, the USSR). (3) The most recent phase began in 1969 with the voyage through the Northwest Passage of the US oil tanker Manhattan. This event galvanized the Canadian government into enacting protective legislation for their Arctic lands, including pollution controls against the possibility of large-scale oil spills. These various historical patterns show Can-

ada's preoccupation with the immediate regional effects of events in the Arctic, regardless of the true thrust of US intentions in these regions. (Harris-Wisconsin)
W80-03852

ENVIRONMENTAL PROTECTION FOR WHOM,
Hampshire Coll., Amherst, MA. Dept. of Political Science.
For primary bibliographic entry see Field 6B.
W80-03853

ENVIRONMENTAL QUALITY AND ECONOMIC DEVELOPMENT,
Mobil Oil Corp., New York.
D. Heath.
Annals of the American Academy of Political and Social Science, Vol 444, p 46-55, July 1979.

Descriptors: *Legislation, *Economics, *Costs, *Environmental control, Environment, Regulation, Benefits, Clean Air Act, Federal Water Pollution Control Act, Legal aspects, Environmental Protection Agency, Return(Monetary), Marginal return, Public health, Economic development, Control, Cost-benefit analysis, Income, Conservation, Governments.

Environmental laws of the United States specifically the Clean Air Act, Water Pollution Control Act, and Resource Conservation and Recovery Act, jeopardize the future well-being of its people. Overcontrol mandated or permitted by these laws is too costly even for an affluent society. Environmental over-control's high cost will cut deeply into family income over the next decade without providing any measurable improvement in health. In 1977, the U.S. spent $40 billion to comply with the three laws. By 1986, the total cost is expected to be $86 billion/yr (1977 dollars), more than double 1977 costs. In 1977, environmental laws cost each American family $600. By 1986 each family will be paying $1,300/yr (1977 dollars) to meet these laws. During 1977, clean-up costs were not critical and large gains were made at relatively low cost; but the law of diminishing returns, where small incremental improvements are very costly, is at work. Governmental overcontrol is evident in five areas: (1) standards based on studies of questionable values, (2) standards based on trivial health effects, (3) excessive safety margins, (4) widening list of pollutants deemed dangerous to health, and (5) arbitrary standards. (Danovich-Wisconsin)
W80-03857

MULTINATIONAL CORPORATIONS, NATION-STATES AND OCEAN RESOURCE MANAGEMENT: THE IMPACT OF THE WORLD'S 200-MILE ECONOMIC ZONE ON MULTINATIONAL AND NATIONAL DEVELOPMENT,
Hawaii Univ., Honolulu. Coll. of Tropical Agriculture.
C. Gopalakrishnan.
American Journal of Economics and Sociology, Vol 38, No 3, p 253-260, July 1979. 2 Tab, 9 Ref. JC-UH Sea Grant 7902.

Descriptors: *Oceans, *Developing countries, *Resources development, *Multinational corporations, *200 Mile exclusive economic zones, Governments, Economics, Law of the sea, Capital, Technology, Resource allocation, Resource management, Coasts, Oil, Legal aspects, Cooperation, Economic impact, Economic development, Exploitation, Natural resources.

Harmonization of the relationship between mulination corporations and nation-States will significantly increase because of a 200-mile exclusive economic shoreline zone in the world oceans. If coastal State's jurisdication extends 200 miles, a fact of international law about to receive juridicial status, a new regime of ocean resource use will emerge. This arrangement will most likely consist of a synergistic partnership of powerful nation-States and powerful multinational corporations, rather than overwhelming dominance and subjugation of one by another. From the perspective of resource use optimization and externalities, less-developed coastal states gain from enlisting the support of multinational corporations. Less developed coastal states lack key factors (capital, technology and managerial skill) necessary to tap oceanic resources. These marine technology factors exist primarily in the private sector. Multinational corporation activity generates new investment and employment opportunities, increases export earnings and improves balance-of-payments for these countries. Multinational corporations also derive numerous benefits, including high marginal capital efficiency and ready access to much-needed resources. What emerges is a unique situation of strong inter-dependence, where one party's strengths are automatically the other's weaknesses and vice-versa. (Danovich-Wisconsin)
W80-03859

LEGAL AND INSTITUTIONAL FACTORS AFFECTING MARICULTURE IN TEXAS,
Mc Glew and Brown, Austin, TX.
P. A. Mc Glew, and D. E. Brown.
Coastal Zone Management Journal, Vol 6, No 1, p 69-88, 1979.

Descriptors: *Texas, *Shellfish farming, *Aquatic animals, Water supply, Federal government, Shrimp, Bays, Dredging and filling, Waste disposal, Legal aspects.

Aquaculture is the technique of farming aquatic animals or plants. Mariculture includes what is popularly known as shrimp farming. Aquaculture and its specialized cousin, mariculture, provide some potential additional food sources and economic revenues. Technological barriers to increased mariculture production are being removed, but many legal and institutional barriers remain. Examples of the current and potential regulation of mariculture in Texas by state and federal authorities are examined. The effect of various state and federal regulations on the development of mariculture is discussed from a legal and institutional viewpoint. The potential for growth of mariculture is considered questionable without regulatory reforms, particularly at the federal level. Examined are the legal constraints in water supply, use of bay bottoms and the water column, dredging and filling operations, limited mariculture operations, waste disposal, taxation and financial aid, pesticides, and state authority over fisheries. The most significant problem facing new entrants into mariculture appears to be the indefiniteness of regulation. Recommendations are given that will remove some of the legal barriers to increased mariculture operations. (Corey-Florida)
W80-03873

WATER RESOURCE POLICIES AND AUTHORITIES: FEDERAL PARTICIPATION IN SHORE, HURRICANE, TIDAL AND LAKE FLOOD PROTECTION (FINAL RULE).
Corps. of Engineers, Washington, DC. Washington District.
Federal Register, Vol 44, No 15 p 4594-4603, January 22, 1979. 1 Tab, 1 App.

Descriptors: *Coastal plains, *Shore protection, *Flood protection, Beaches, Water resources, Cost sharing, Regulation, Federal government, Hazards, Hurricanes.

This regulation provides policies to United States Army Corps of Engineers Offices describing the extent of federal involvement in projects which provide shore, hurricane, tidal and lake flood protection. It is intended to update previous regulations to reflect recent changes in legislation and policy. This regulation makes reference to and provides a synopsis of the program legislation which it affects. The general program policy of the Corps is to undertake projects to prevent erosion and flooding of the coastal areas when those projects best serve the public interest. Special consideration is given to geographic applicability, coastal zone management plans, beach creation, shore categories, public use, and improvements for recreation. The role of the federal government is defined regarding pre-authorization studies, construction maintenance, periodic nourishment and work for other federal agencies. Cost sharing among federal and private concerns and the requirements for local cooperation are set forth. (Corey-Florida)
W80-03877

SALE AND LEASE OF INDIAN WATER RIGHTS,
B. Leaphart.
Public Land and Resources Law Digest, Vol 10, No 2, p 280-290, 1973.

Descriptors: *Indian reservations, *Water allocation(Policy), *Water resource development, Irrigation, Water resources, Federal government, Treaties, Rivers, Water law, Judicial decisions.

The leading case concerning Indian water rights is United States v. Winters, a 1908 Supreme Court decision. In stating that the water of the Milk River-the boundary of an Indian reservation could not be appropriated, the Court stated that the Indians had the entire use of the river's water rights. The 'Winters Doctrine' as developed by subsequent cases, has come to represent three basic propositions: (1) The priority date of a water right is the date the reservation is created, (2) The rights need not be exercised presently; and (3) The quantity of water to be enjoyed is measured by Indian needs, both present and future. In our industrialized nation, the concept of Indian 'need' should not be restricted to traditional agrarian purposes. The water reserved under the Winter's Doctrine should be open to the same development as other resources. As trustee for the Indians, the government should provide for the leasing of reserved waters for use of the Indian reservation. The sale and lease of water rights would enhance the reservation's economy. (Wilson-Florida)
W80-03880

OWNER ELIGIBILITY RESTRICTIONS - ACREAGE AND RESIDENCY,
Water and Power Resources Service, Sacramento, CA. Mid-Pacific Region.
C. R. Renda.
Natural Resources Lawyer, Vol 8, No 2, p 265-280, 1975.

Descriptors: *Federal Reclamation Law, *Water distribution(Applied), *California, Reclamation, Legislation, Federal jurisdiction, Water law, Water allocation(Policy), Legal aspects, Federal project policy, Administrative agencies.

Acreage and residency problems under reclamation law are not new. They have existed since the original 1902 Reclamation Act (Act). Current problems involving federal reclamation projects typically concern the development of private lands and the application of owner eligibility restrictions. Section 5 of the Act imposes a 160 acre limit for water rights from federal projects. These are referred to as 'non-excess lands'. However, the Bureau of Reclamation (Bureau) has permitted owners of larger tracts to make application for water covering all their lands subject to the condition that these 'excess lands' be subsequently transferred to an eligible person. Enforcement of these contractual promises is extremely difficult. Problems arise in regard to transfers to joint tenants, trusts, partnerships, corporations, and other legal arrangements. The Act also requires the participating landowner to be a bona fide resident or occupant of that land. The Bureau has not enforced this requirement since the 1926 Omnibus Adjustment Act. A United States District Court held in 1972 that the restriction is required by the Act, as a continuing restriction upon the right to receive project water. As of this article, that decision was on appeal. (Wilson-Florida).
W80-03883

SPATIAL ASPECTS OF THE PRESSURE FOR SHORELINE DEVELOPMENT: THE EXAMPLE OF PUGET SOUND,
Ottawa Univ. (Ontario). Dept. of Geography and Regional Planning.
P. Harrison.
Coastal Zone Management Journal, Vol 2, No 2, p 125-148, 1975.

Descriptors: *Washington, *Spatial distribution, *Water management(Applied), Coasts, Management, Legislation, Urbanization, Developed waters, Water law, Water resources development, Shores.

When environmental legislation is enacted, the nature and spatial structure of the resulting management area are rarely considered in any detail. Several specific variables create different spatial pressures on the use of salt water shorelines. Population growth, urbanization, employment structure, and personal income in the Puget Sound region of Washington are analyzed. The bulk of population, wealth, and economic activity in Washington state is in the Puget Sound area. The Seattle-Tacoma metropolitan area is the source of much pressure for further shoreline development. The spatial expression of this development is analyzed in two contexts: (1) 'Spread' development or low density use spread in a line along the shoreline; and (2) 'Nucleated' development involves the use of less shoreline, but with higher density of use. Through 'spatial dominance' the more affluent areas affect and control economic development. Recent shoreline management legislation completely ignores those spatial phenomena. The burden of shorelines management is placed upon local authorities. Ironically, poorer rural counties then must provide for the spillover and domination effect of the more affluent municipality areas. Giving counties the initiative in shoreline management is no guarantee that differential spacial structure will be taken into account. (Wilson-Florida).
W80-03884

WILL JUDICIAL ERROR ALLOW INDUSTRIAL POINT SOURCES TO AVOID BPT AND PERHAPS BAT LATER. A STORY OF GOOD INTENTIONS, BAD DICTUM, AND UGLY CONSEQUENCES,
Weston, Hurd, Fallon, Paisley, and Howley, Cleveland, OH.
J. S. Kalur.
Ecology Law Quarterly, Vol 7, No 4, p 955-988, 1979.

Descriptors: *Federal Water Pollution Control Act, *Water quality standards, *Water pollution control, Regulation, Legislation, Effluents, Industrial wastes, Judicial decisions, Water pollution sources, Water law, Administrative agencies.

Section 301 (6) of the Federal Water Pollution Control Act Amendment (FWPCA) is the heart of a plan to reduce or eliminate water pollution discharges from point sources. By July 1, 1977, all dischargers were to have achieved compliance with designated effluent limitations via installation of the 'best practicable technology' (BPT) at all point sources. To fill the expected period between passage of the FWCPA and establishment of limitations, an interim permit program was created by section 402 (a) (1) which allowed lawful discharge prior to the adoption of BPT. The Federal Environmental Protection Agency has generally failed to include provisions to assume BPT compliance in the interim permits. Since most permits were issued for five years, a postponement of compliance was approved by the Supreme Court in du Pont v. Train. The intent of Congress was to require uniformity in water pollution control. The failure of industrial point sources to meet BPT limitations by the deadline has thwarted this plan. (Wilson-Florida)
W80-03885

'ONE PERSON, ONE VOTE' AND CALIFORNIA'S WATER DISTRICTS,
Auburn Univ., AL.
D. L. Martin.
Natural Resources Lawyer, Vol 8, No 1, p 9-28, 1975.

Descriptors: *California, *Water districts, *Constitutional law, Judicial decisions, State government, Water law, Legal aspects, Public utilities, Irrigation, Districts, Decision making water policy.

Special districts performing water utility operations in California have a variety of enabling acts to which reapportionment challenges have been raised in the courts. Some elect their directors on a resident voting basis. Others restrict the franchise to landowners, with votes proportioned to the number of acres held or according to assessed valuation. The legal challenges over existing voting arrangements are fundamentally a struggle for control over vast economic resources. The issue has been whether the 'one person, one vote' finding of the reapportionment revolution of the 1960's should be extended to water districts. The judicial analysis has traditionally been in terms of whether the principal purpose of the special water district was to provide services without exercising the general powers of government. In 1973, the United States Supreme Court declined to intervene in the voting arrangements of a water storage district. The majority held that the district provided none of the general public services attributed to a governing body. The courts face future challenges in defining the applicability of the Equal Protection Clause to quasi-public utility districts. (Wilson-Florida)
W80-03886

THE CONVENTION FOR THE PREVENTION OF MARINE POLLUTION FROM LAND-BASED SOURCES: AN EFFECTIVE METHOD FOR ARBITRATING INTERNATIONAL EFFLUENT POLLUTION DISPUTES,
R. H. Busby.
California Western International Law Journal, Vol 5, No 2, p 350-375, Spring 1975.

Descriptors: *Water pollution control, *International commissions, *International law, Effluents, Coasts, Pollutants, Water law, Water pollution, Oceans, Legal aspects.

Effluent pollution, broadly defined as the flow of waste materials into rivers and coastal seas, has reached alarming proportions. This pollution is produced primarily by man's land-based industrial activities. Effluent pollution occurs mainly in the coastal waters. Arbitration, diplomacy, and litigation are among the methods available to the international community to control and combat this form of marine pollution. Diplomatic channels have drawbacks which prohibit their effective use against pollution: (1) lack of speed and directness; (2) national interests; and (3) suspicion by lesser developed nations of economic coercion. Litigation is hindered in its effectiveness by problems with jurisdiction, determining the proper party to bring the action, and appropriate theories of liability. International arbitration has been effectively employed as a means to settle disputes. Submission of a conflict to arbitration minimizes political maneuvering and permits concentration on the merits of the controversy. The Convention for the Prevention of Marine Pollution from Land-Based Sources, utilizing arbitration, presents guidelines for a comprehensive, regionally organized effort at pollution control. The waters in which its provisions apply are multi-national. Its flexibility and potential speed of action make it an important tool against pollution. (Wilson-Florida)
W80-03887

LITIGATION OF THE RECLAMATION LAW IN THE IMPERIAL VALLEY: WHO HAS STANDING TO CHALLENGE WHICH LAW,
For primary bibliographic entry see Field 3F.
W80-03888

MARINE RESOURCES COMMITTEE-ANNUAL REVIEW OF SIGNIFICANT LEGISLATIVE, JUDICIAL AND ADMINISTRATIVE ACTIVITIES DURING 1977.
American Bar Association, Washington, DC. Natural Resources Law Section.
Natural Resources Lawyer, Vol 11, No 1, p 76-97, 1978.

Descriptors: *Marine fisheries, *Shore protection, *Water pollution control, Legislation, Judicial decisions, Administrative decisions, International commissions, Fisheries, Mining, Federal government, Oceans.

A review of legal activity related to United States offshore seabed resources, reveals: (1) Two bills were introduced in Congress to amend the Outer Continental Shelf Lands Act, but were not enacted; (2) the Secretary of the Interior established a new policy for lease sales. Concerning deepwater ports, the Secretary of Transportation issued several licenses with some new modifications of the conditions contained in the forms of license. Regarding coastal zone management, regulations written by the Office of Coastal Zone Management to implement the Coastal Energy Impact Program come under frequent attack in Congress. Coastal zone management plans in Oregon and California were approved. The most significant activity in the fisheries area was the implementation of the Fishing and Conservation Act. As to deep seabed hard minerals, the United Nations Conference on the Law of the Sea issued an 'Informal Composite Negotiating Text'. Congress considered legislation to regulate high seas mining by American ships. Regarding the preservation of the marine environment, several states passed comprehensive oil spill liability laws. The federal courts upheld several pollution statutes. Voluntary pollution liability agreements are discussed. President Carter submitted proposed new rules, regarding the transportation of marine resources, under the authority of the 1972 Ports and Waterways Safety Act. These are applicable to all ships trading to United States ports. (Wilson-Florida)
W80-03889

6F. Nonstructural Alternatives

EMPLOYMENT IN THE FISHING INDUSTRY: SOME PRELIMINARY FINDINGS ON FISHERMEN'S MOBILITY,
C. L. Yap.
The Developing Economies, Vol 16, No 3, p 283-297, September, 1978. 13 Tab, 12 Ref.

Descriptors: *Commercial fishing, *Social mobility, *Malaysia, *Labor supply, Fisheries, Employment, Employment opportunities, *Social aspects, Social needs, Trawling, Income, Labor, Labor mobility, Size, Education.

large numbers of children per family, their low education and training level, and their occupational immobility are the main reasons for a cycle of overmanned fishing boats and individual underemployment in Malaysia. Money, used to subsidize fishery expansion in waters already overfished, is better utilized by training and equipping young people less entrenched in the traditional social setup to take on other occupations. Alternatively, incentives may be provided to the private sector to locate their manufacturing plants and business enterprises near fishing communities. Social dislocation may be less than that experienced by an individual exercising his own initiative. Malay peasant fishermen have an extended family system in which it is socially unacceptable to exclude a relative or friend who is unemployed from sharing in a catch. Fisherman remuneration is by profit sharing. When the trawl net was adopted in 1965, many people took up fishing, leading to overfishing and extreme employment fluctuations. A study in findings, one of the most important fishing districts in Peninsular Malaysia, show that 78% of the fishermen are intra-district movers and only 22% are inter-district/state movers. The ratio of child movers to parents varies 0.4-0.7:1, indicating low mobility. Mean average number in a family is 6-7. Only 82.4% of fishermen have attended primary schools and 0% have received secondary schooling. (Danovich-Wisconsin)
W80-03856

MULTINATIONAL CORPORATIONS, NATION-STATES AND OCEAN RESOURCE MANAGEMENT: THE IMPACT OF THE WORLD'S 200-MILE ECONOMIC ZONE ON MULTINATIONAL AND NATIONAL DEVELOPMENT,
Hawaii Univ., Honolulu. Coll. of Tropical Agriculture.
For primary bibliographic entry see Field 6E.
W80-03859

6G. Ecologic Impact Of Water Development

EMPLOYMENT IN THE FISHING INDUSTRY: SOME PRELIMINARY FINDINGS ON FISHERMEN'S MOBILITY,
For primary bibliographic entry see Field 6F.
W80-03856

7. RESOURCES DATA

7B. Data Acquisition

INSTRUMENTATION OF URBAN HYDROLOGY MONITORING SITES IN SOUTHEAST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. Hardee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-123417, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-37, July 1979. 38 p, 23 Fig, 9 Ref.

Descriptors: *Instrumentation, *Urban hydrology, *Florida, *Data collections, *Monitoring, Sites, Sampling, Rainfall, Urban runoff, Storm runoff, Storm drains, Water quality, Measurement, Logging(Recording), Analog models, Venturi flumes, *U-shaped constriction, *Stilling well, *Electromagnetic velocity meter, Southeast Florida.

An instrumentation system developed and built in laboratories of the U.S. Geological Survey, Reston, Va., has been used since 1974 to collect synchronized rainfall, runoff, and water-quality data from urban basins. A number of field modifications were made to adapt the system to local hydrologic conditions and for collection of data on about 350 rainstorms at four sites in south Florida. The instrumentation system measures rainfall at three sites, records two pressure or water-level readings for flow computations, and collects and refrigerates up to 24 water samples and rainfall-quality samples. Rainfall and runoff data are recorded every 36 seconds on a six-channel analog recorder so that all variables are time-synchronous. Flow in the storm sewer is computed from pressure measurements in a U-shaped venturi-type constriction or, when the constriction is not used, from water levels. (Kosco-USGS)
W80-03766

7C. Evaluation, Processing and Publication

EROSION POTENTIAL ASSESSMENT FOR THE WILLAMETTE RIVER BASIN, OREGON,
California Inst. of Tech., Pasadena. Environmental Quality Lab.
W. M. Brown, III.
In: River-Quality Assessments; Proceedings of a Symposium held in Tucson, Arizona, November 2-3, 1977. p 84-100, 1978. 2 Fig, 4 Tab, 18 Ref.

Descriptors: *Water quality, *Erosion, *River basins, *Oregon, Watersheds(Basins), Synoptic analysis, Planning, Sedimentation, Mapping, Environment, Analytical techniques, Soil erosion, Land use, Precipitation(Atmospheric), Runoff, Vegetation, Soils, Deposition(Sediments), Aerial photography, Methodology, Topography, *Willamette River Basin(OR), Matrix methods.

A synoptic approach was devised to delineate the relationships that exist between physiographic factors, land-use activities, and resultant erosional problems. The approach involves the development of an erosional-depositional province map and a numerical impact matrix for rating the potential for erosional problems. The province map is prepared by collating data on the natural terrain factors that exert the dominant controls on erosion and deposition in each basin. In addition, existing erosional and depositional features are identified and mapped from color-infrared, high-altitude aerial imagery. The axes of the impact matrix are composed of weighting values for the terrain factors used in developing the map and by a second set of values for the prevalent land-use activities. The body of the matrix is composed of composite erosional impact ratings resulting from the product of the factor sets. Together the province map and problem matrix serve as practical tools for estimating the erosional impact of human activities on different types of terrain. The approach has been applied to the Willamette River basin, Oregon, and has proven useful for the recognition of problem areas. The erosional potential map and matrix are useful tools for (1) immediate land-use planning, (2) the selection and monitoring of best management practices, and (3) the design of data collection programs to assess land and river quality. For all three purposes, the tools are flexible, because through interpretation of aerial photography, they can be regularly updated to provide information under rapidly changing conditions. (See also W80-03606) (Humphreys-ISWS)
W80-03613

HYDRAULICS OF FLOW IN THE KASKASKIA RIVER, ILLINOIS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 2E.
W80-03713

INDEX TO SOURCES OF HYDROLOGIC DATA,
California State Dept. of Water Resources, Sacramento.
Bulletin 230-78, July 1978. 321 p, 5 Tab.

Descriptors: *Hydrologic data, *Data collections, *California, *Stations, Information retrieval, Surface waters, Water quality, Groundwater, Groundwater resources, Gaging stations, Drainage area, Water levels, Wells, Well data.

This first edition of 'Index to Sources of Hydrologic Data' comprises four independent sections: an index to surface water measurement stations, an index to surface water quality stations, an inventory of groundwater wells and data, and a list of current publications on climatological data. Initiation of this new periodic series as a reference publication replaces the Department's series of data publications, 'Hydrologic Data'. Bulletin 230 represents a fundamental change: rather than reporting the data, it provides both a summary of sources from which the data may be obtained and the Water Data Information System (WDIS). WDIS is a computer-based system that presently manages surface water quality data, groundwater level measurements, and groundwater quality data. This means that data of these disciplines can be retrieved or evaluated by using a common group of record identification fields. Among these are Hydrographic Areal Designation, Station Number, Date and Time (of observation), and County. Other fields--or addresses--not yet common to all the disciplines are Latitude and Longitude and the U.S. Public Land Survey (Township, Range, and Section). Data are presently entered, stored, and retrieved at the Department's computer center in Sacramento. Data in the water quality disciplines are summarized under six parameter groups: minerals, nutrients, minor elements, supplemental minor elements, miscellaneous, and pesticides. WDIS has about 120 electronic data processing programs written to store, retrieve, evaluate, and print out data for water quality and groundwater level measurements. (Humphreys-ISWS)
W80-03744

WATER RESOURCES DATA FOR INDIANA, WATER YEAR 1978.
Geological Survey, Indianapolis, IN. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-144355, Price codes: A17 in paper copy, A01 in microfiche. Geological Survey Water-Data Report IN-78-1, September 1979. 383 p, 4 Fig, 3 Tab.

Descriptors: *Indiana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Indiana consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels in wells. This report contains discharge records for 194 gaging stations, stage and contents for 13 lakes and reservoirs, water quality for 49 gaging stations, and water levels for 59 observation wells. Also included are 124 crest-stage partial-record stations and 49 low-flow partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal Agencies in Indiana. (Kosco-USGS)
W80-03752

WATER RESOURCES DATA FOR ALASKA, WATER YEAR 1978.
Geological Survey, Anchorage, AL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-143910, Price codes: A19 in paper copy, A01 in microfiche. Geological Survey Water-Data Report AK-78-1, November 1979. 425 p, 4 Fig.

Descriptors: *Alaska, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1978 water year for Alaska consist of records of stage, discharge, and water quality of streams; stage and water quality of lakes; and water levels and water quality in wells and springs. This report contains discharge records for 117 gaging stations, stage only records for 2 gaging stations, water quality for 64 stations, and water levels for 28 observation wells. Also included are 79 low-flow, 87 crest-stage, and 24 water-quality partial-record stations. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements of discharge, lake stage, or water quality. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Alaska. (Kosco-USGS)
W80-03753

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-1. SOUTHWEST FLORIDA SURFACE WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-124662, Price codes: A13 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-3A-1, September 1979. 272 p, 10 Fig, 1 Tab.

Descriptors: *Florida, *Hydrologic data, *Surface waters, Gaging stations, Streamflow, Flow rates, Lakes, Reservoirs, Water levels, Data collections, Sites, Southwest Florida, *Lake elevations.

Water resources data for the 1978 water year in Florida consist of discharge records for 295 streams, stage-only records for 206 streams, elevations for 216 lakes, water level measurements for 1134 wells and crest-stage partial-records for 54 streams. Water quality data for approximately 550 streams or lakes and 1050 wells are included. The data in this volume for Southwest Florida includes discharge records for 70 streams, stage-only records for 24 streams, elevations for 110 lakes, miscellaneous measurements, and crest-stage partial records for 12 streams. These data represent the

National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (Kosco-USGS)
W80-03754

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3A-2. SOUTHWEST FLORIDA SURFACE WATER QUALITY.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-126386, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-3A-2, September 1979. 614 p, 3 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Surface waters, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Data collections, Sites, Southwest Florida.

Water resources data for the 1978 water year in Florida consist of discharge records for 295 streams, stage-only records for 206 streams, elevations for 216 lakes, water level measurements for 1134 wells and crest-stage partial-records for 54 streams. Water quality data for approximately 550 streams or lakes and 1050 wells are included. The data in this volume for Southwest Florida includes water quality data for approximately 245 surface water sites. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (Kosco-USGS)
W80-03755

WATER RESOURCES DATA FOR FLORIDA, WATER YEAR 1978--VOLUME 3B. SOUTHWEST FLORIDA GROUND WATER.
Geological Survey, Tallahassee, FL. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-126394, Price codes: A99 in paper copy, A01 in microfiche. Geological Survey Water-Data Report FL-78-3B, September 1979. 616 p, 19 Fig, 1 Tab, 9 Ref.

Descriptors: *Florida, *Hydrologic data, *Groundwater, *Water quality, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, Southwest Florida.

Water resources data for the 1978 water year in Florida consist of discharge records for 295 streams, stage-only records for 206 streams, elevations for 216 lakes, water level measurements for 1134 wells and crest-stage partial-records for 54 streams. Water quality data for approximately 550 streams or lakes and 1050 wells are included. The data in this volume for Southwest Florida includes periodic water level measurements for 450 wells and water quality data for approximately 300 wells. These data represent the National Water Data System records collected by the U.S. Geological Survey and cooperating local, State and Federal agencies in Florida. (Kosco-USGS)
W80-03756

SURFACE-WATER FEATURES IN OSCEOLA COUNTY AND ADJACENT AREAS, FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. H. Hughes, and J. M. Frazee, Jr.
Geological Survey open-file report 79-1289 (WRI), 1979. 1 Sheet, 11 Fig, 3 Tab, 4 Ref.

Descriptors: *Surface waters, *Hydrologic properties, *Florida, *Water quality, *Lakes, Basins, Streams, Streamflow, Drainage, Rainfall, Evapotranspiration, Evaporation, Gaging stations, Sampling, Sites, Hydrologic data, Chemical analysis, Maps, *Osceola County(Fla).

The western two-thirds of Osceola County, Fla., drains southward by way of the Kissimmee River and its tributaries; the eastern one-third drains eastward to the St. Johns River or to marshy areas that make up part of the headwaters of the St. Johns River. About 15 percent of the county is covered by several hundred lakes whose surface areas range in size from a few to several thousand acres. Much of the natural drainage has been altered by canalization or regulated by control structures. Under natural conditions streamflow is seasonal, usually high in September or October and low in May or June, in phase with the rainy season. Control structures are used to maintain lake levels within a relatively small range in stage, producing greater seasonal variations in river flow than before regulation. Dissolved-solids concentration of much of the surface water is less than 240 mg/l, in some, much less. The water typically is of calcium bicarbonate type. Color is fairly high, in water draining from swamps, where the pickup of humic acids is significant. (Kosco-USGS)
W80-03761

PLACES IN CONNECTICUT WHERE GROUND WATER IS KNOWN TO HAVE DETERIORATED IN QUALITY,
Geological Survey, Hartford, CT. Water Resources Div.
J. L. Rolston, I. G. Grossman, R. S. Potterton, Jr., and E. H. Handman.
Available from: USGS 1200 S. Eads St. Arlington, VA price. 75. Geological Survey, Miscellaneous Field Studies Map MF-981-G, 1979. 1 Sheet, 2 Ref.

Descriptors: *Maps, *Connecticut, *Groundwater, *Water pollution sources, *Water quality control, Water analysis, Aquifers, Water wells, Path of pollutants, Saline water intrusion, Coasts.

A map of Connecticut, scale 1:125,000, shows locations of wells known to have produced contaminated water and their relation to favorable aquifers. About 450 wells are included. The map also delineates the coastal area vulnerable to saltwater intrusion. (Kosco-USGS)
W80-03762

SELECTED WATER RESOURCES DATA, CLARION RIVER AND RED-BANK CREEK BASINS, NORTHWESTERN PENNSYLVANIA--PART 2,
Geological Survey, Pittsburgh, PA. Water Resources Div.
T. F. Buckwalter, C. H. Dodge, and G. R. Schiner.
Available from the National Technical Information Service, Springfield, VA 22161 as PB80-104915, Price codes: A03 in paper copy, A01 in microfiche. Geological Survey Water-Resources Investigations 79-19, July 1979. 135 p, 51 Fig, 8 Tab, 8 Ref.

Descriptors: *Hydrologic data, *Groundwater resources, *River basins, *Pennsylvania, *Basic data collections, *Water quality, Surface waters, Aquifers, Water levels, Water yields, Water wells, Springs, Chemical analysis, Sampling, Sites, Water analysis, Trace elements, Aquatic insects, *Northwestern Pennsylvania, Clarion River Basin(Pa), Redbank Creek Basin(Pa).

This report presents selected basic data collected during a study of the water resources of the Clarion River and Redbank Creek basins in northwestern Pennsylvania. Hydrologic information including data on aquifers, water levels, and yields is presented for 1,304 wells. Records for 51 springs are also given. The report contains 83 chemical analyses of water samples collected from 30 stream sites and 300 analyses of water from 196 wells and 43 springs. Also included are 103 trace-element analyses. Monthly and annual means of groundwater levels for six observation wells are tabulated. Benthic invertebrate data from 136 stream sites are listed. Locations of data-collection sites are shown on 50 page-size reductions of 7.5-minute topographic quadrangle maps. (Kosco-USGS)
W80-03770

SUMMARY OF U.S. GEOLOGICAL SURVEY INVESTIGATIONS AND HYDROLOGIC CONDITIONS IN THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT FOR 1978,
Geological Survey, Tallahassee, FL. Water Resources Div.
R. L. Knutilla, and H. C. Rollins.
Available from: OFSS Bx 25425 Fed. Ctr. Denver, CO paper copy 16. microfiche $3.50. Geological Survey open-file report 79-1257, 1979. 118 p, 35 Fig, 3 Tab, 6 Ref.

Descriptors: *Water resources, *Projects, *Publications, *Abstracts, *Bibliographies, Groundwater, Surface waters, Water quality, Streamflow, Water supply, Water utilization, Water resources development, Reviews, Florida, *Southwest Florida.

This report summarizes water-resources investigations in the Southwest Florida Water Management District performed by the U.S. Geological Survey, Water Resources Division, for fiscal year 1978. The investigations are part of the Federal program of appraising the nation's water resources. The cooperative program for fiscal year 1978 included 37 interpretive investigations. Abstracts of 30 reports released during 1978 and a bibliography of reports released since 1933 are included. The hydrologic setting of southwest Florida and discussions of surface-water, ground-water, and quality-of-water conditions are given. Hydrologic conditions in southwest Florida are described and illustrated by hydrographs of selected surface-water, ground-water and lake-stage data collection sites. In addition, summaries of water-use data and data on the regional observation monitor-well program are provided. (Kosco-USGS)
W80-03771

INTERPRETATION OF UNENHANCED LANDSAT IMAGERY FOR WETLAND AND LAND USE DELINEATION IN THE TEXAS COASTAL ZONE,
Texas Univ. at Austin. Bureau of Economic Geology.
R. J. Finley.
Transactions--Gulf Coast Association of Geological Societies, Vol 26, p 279-297, 1976. 14 Fig, 4 Tab, 16 Ref.

Descriptors: *Wetlands, *Texas, *Remote sensing, *Terrain analysis, Coastal marshes, Mapping, Land use, Satellites(Artificial), Distribution patterns, Maps.

LANDSAT imagery was used in a procedure dependent on optical enlargement of part of a band 7 1:1,000,000 image to fit an existing 1:250,000 map base. Land-water and other boundaries were placed on an overlay on which unit boundary data was interpreted from both other bands and the false-color composite of bands 4, 5, and 7. Each resulting map unit was then classified according to a bi-level classification scheme. Level I classes include urban areas, agricultural land, grassland, woodland, water, wetlands, and barren lands. Twenty-three Level II categories included five wetland classes: topographically low marshes, topographically high marshes, tidal flat, grass and algal flats, and vegetated spoil. Water was separated into four Level II classes on the basis of turbidity. Comparison of the LANDSAT maps with aerial photography, published maps, and field data has shown that the Level II category delineation limits are primarily dependent on size of the map unit relative to LANDSAT's resolution limits and on reflectivity contrast with surrounding units. Other factors influencing accuracy include homogeneity of the map unit, spatial position with respect to surrounding units, season of the year in which imagery was taken, and image quality. (Steiner-Mass)
W80-03878

8. ENGINEERING WORKS

8B. Hydraulics

FORMULATING LAKE MODELS WHICH PRESERVE SPECTRAL STATISTICS,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2H.
W80-03605

ON THE CALCULATION OF THE WIDTH AVERAGED FLOW DUE TO LONG WAVES IN AN OPEN CHANNEL,
Victoria Univ. of Manchester (England). Simon Engineering Labs.
For primary bibliographic entry see Field 2E.
W80-03619

MEASUREMENTS OF COMBINED OSCILLATORY AND STEADY FLOW OVER A ROUGH BED,
MacDonald (Sir M.) and Partners, Cambridge (England).
C. B. George, and J. F. A. Sleath.
Journal of Hydraulic Research, Vol 17, No 4, p 304-313, 1979. 10 Fig, 8 Ref.

Descriptors: *Steady flow, *Velocity, *Flow, Roughness(Hydraulic), Roughness coefficient, Hydraulics, Anemometers, Currents(Water), Waves(Water), Sediment transport, Equations, Open channel flow, Laboratory tests, Analytical techniques, Analysis, Model studies, *Oscillatory flow, Rough bed.

Measurements are described of the fluid velocities close to a rough bed oscillating in its own plane in a chamber with superimposed mean drift. The measurements were made in air with a hot-wire anemometer. It was found that over a wide range of conditions the common assumption that the combined flow may be treated as the vector sum of the steady and oscillatory flows separately is incorrect. In all cases investigated, the drift near the bed was less than that which would have been expected in the absence of non-linear interaction between the oscillatory and steady flows. For certain conditions the drift near the bed was actually in the opposite direction to that of the superimposed flow. (Lee-ISWS)
W80-03620

OBSERVATIONS OF STRATIFIED FLOW PAST THREE-DIMENSIONAL BARRIERS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Earth and Planetary Sciences.
P. G. Baines.
Journal of Geophysical Research, Vol 84, No C12, p 7834-7838, December 20, 1979. 7 Fig, 7 Ref. NSF OCE78-19833.

Descriptors: *Flow, *Flow around objects, *Laboratory tests, Flumes, Hydraulic models, Model studies, Fluid mechanics, Barriers, Stratified flow, Hydraulics, Hydrology.

Experiments on stratified flow at large Reynolds numbers over barriers with gaps, towed along the bottom of a long tank, were described. The primary purpose of the observations was to determine the circumstances under which fluid flows over the barrier or is deflected horizontally around the barrier through the gap. A range of gap widths (including zero) was used, and the barrier had 'Witch of Agnesi' profile with height about half width. For the two-dimensional barrier (i.e., zero gap), blocked fluid was observed upstream if F = U/Nh was less than 0.5. For the same barrier with a gap, if F was less than 0.5, all the fluid incident below a certain height z sub s(less than h) flowed around the barrier through the gap; above this height the fluid flowed over the barrier in nearly two-dimensional fashion. The parameter z sub s was a function of both F and gap width. For F greater than 0.5 all (or almost all) of the fluid incident on the barrier flowed over it, and the motion was predominantly two dimensional in the vertical plane. (Sims-ISWS)
W80-03624

FLOW VISUALIZATION IN COMPLEX TURBULENT FLOWS,
Chiap Hua Comalco Ltd., Kowloon (Hong Kong).
L. H. Y. Lee, and J. A. Clark.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15209, p 247-268, February 1980. 14 Fig, 2 Tab, 37 Ref, 1 Append.

Descriptors: *Turbulence, *Boundary layers, *Flow separation, *Shear, Model studies, Hydraulic models, Flumes, Jets, Injection, Flow, Turbulent flow, Flow friction, Transition flow, Viscosity, Bubbles, Entrainment, Hydrodynamics, Hydraulics, *Flow visualization, Vortices.

Angled injection of submerged laminar plane jets into a turbulent boundary layer developed along a vertical wall of a large recirculating water channel was visualized. The mixing layers associated with the jet and their interaction with the boundary layer and resulting transition mechanisms in the generation of turbulence were described. A recirculation bubble region related to separation was revealed, and primary systematic transverse vortex structures formed in the outer mixing layer of the jet were characterized. A physical model was proposed which describes the initiation, the formation, and the coalescence of vortices as part of a transition process in the development of turbulence. (Sims-ISWS)
W80-03715

DAMPING OF GRAVITY WAVES OVER POROUS BED,
Maine Univ. at Orono. Dept. of Mathematics.
K. K. Puri.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Proceedings Paper 15214, p 303-312, February 1980. 2 Fig, 10 Ref, 3 Append.

Descriptors: *Gravity waves, *Viscous flow, *Beds, *Model studies, Mathematical models, Porous media, Porosity, Permeability, Channels, Flow, Hydrodynamics, Hydraulics, *Wave damping.

The damping of gravity waves over the contaminated free surface of a viscous layer of fluid that is bounded below by a porous bed was investigated. It was assumed that the bed is saturated with the same fluid. The coupled system of linearized equations appropriate to the fluid layer and the porous bed was solved to study the damping of a progressive wave on the surface of the fluid. The dispersion relation yielding the dependence of the frequency on the viscosity on the parameters related to the porous bed, and on the free surface film, was derived. The effect of the latter on the damping of the waves was found to be very signi'ficant. The results obtained subsumed the hitherto known results of other authors. (Sims-ISWS)
W80-03716

STAGED MULTIPORT DIFFUSERS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W80-03717

HYDRAULICS OF RECTANGULAR VERTICAL DROP STRUCTURES,
Ahmadu Bello Univ., Zaria (Nigeria). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W80-03739

AIR BUBBLES IN A CONVECTIVELY ACCELERATED WATER FLOW,
Khartoum Univ. (Sudan). Dept. of Civil Engineering.
A. M. A. Salih.
Journal of Hydraulic Research, Vol 17, No 4, p 315-327, 1979. 6 Fig, 1 Tab, 21 Ref.

Descriptors: *Bubbles, *Flow, *Laboratory tests, *Mathematical models, Model studies, Velocity, Movement, Settling velocity, Instrumentation, Photography, Hydraulics, Civil engineering.

The motion of injected air bubbles of equivalent diameters between 0.98 mm to 6.25 mm was experimentally studied using photographic recordings. The theoretical analysis formulated for this study showed that the relative velocity of the air bubbles approached a state similar to the terminal velocity in still water shortly after being subjected to acceleration. Experimental results conclusively proved that the theoretical approach and formulae were developed to express these experimental findings in accordance with the theoretical and statistical approaches. (Sims-ISWS)
W80-03740

HYDRAULICS OF A LARGE CHANNEL PAVED WITH BOULDERS,
Ministry of Works and Development, Wellington (New Zealand). Power Div.
For primary bibliographic entry see Field 2E.
W80-03741

8E. Rock Mechanics and Geology

PREPARATION OF FRIABLE AQUIFEROUS SPECIMENS,
Humphreys (Howard) and Partners, Reading (England).
P. F. Worthington.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 106, No HY2, Technical Note, p 333-337, February 1980. 2 Fig, 7 Ref, 1 Append.

Descriptors: *Aquifers, *Sampling, *Porous media, *Methodology, Castings, Aquifer characteristics, Testing procedures, Permeameters, Limestones, Groundwater, Sandstones, Protection, Friable specimens.

This note described the procedure adopted for the preparation of friable limestone and sandstone specimens of markedly variable lithology taken from the post-Cretaceous succession of the Kalahari Basin. Preliminary trials with sample fragments demonstrated that their indiscriminate saturation under a vacuum resulted in disintegration. Thus, it was essential that the cubic specimens be cast in a retaining medium before any attempt at saturation. All casting was carried out at room temperature using a commercial liquid, solvent-free epoxy resin (specific gravity 1.15) together with a liquid hardener (specific gravity 1.0) mixed in the ratio 10:1 by weight, and possessing the properties of negligible cure shrinkage, high heat resistance, very low water absorption, and high electrical resistivity. The measurement of intergranular permeability required that each mounted specimen be fixed into a cell. This proposed method for the preparation of friable specimens for petrophysical measurement has several distinct advantages. With the exception of the invaded zones, the specimen is preserved in the same state as in the original core sample. No loss of specimens has been suffered either by disintegration during saturation, flushing and drying, or through uncontrolled contamination by the casting mixture. The specimen is fully protected against accidental damage by the mounting fixture which has proved to be extremely durable. Futhermore, the proposed procedure for the preparation of specimens does not physically impede the subsequent petrophysical investigations. (Humphreys-ISWS)
W80-03719

8I. Fisheries Engineering

A BIOECONOMIC MODEL OF THE GULF OF MEXICO SHRIMP FISHERY,
Texas A and M Univ., College Station. Dept. of Wildlife and Fisheries Sciences.
W. E. Grant, and W. L. Griffin.
Transactions of the American Fisheries Society, Vol 108, No 1, p 1-13, January, 1979. 6 Fig, 5 Tab, 22 Ref. 04-6-158-44108.

Descriptors: *Model studies, *Galveston Bay, Texas, *Commercial fishing, *Shrimp, *Economics, Simulation analysis, Coasts, Bays, Fisheries, Shellfish, Gulf of Mexico, Commercial shellfish, Harvesting, Seasonal, Management, Depth, Rent, Size, Distribution, Income.

A bioeconomic simulation model of the Gulf of Mexico shrimp industry is capable of assessing impacts of alternative management strategies on shrimp harvests. The model accurately predicts general trends in shrimp harvest seasonality and

distribution in relation to shrimp size and water depth. Simulations were confined to the brown shrimp (Penaeus aztecus) fishery in Galveston Bay, Texas and adjacent offshore waters. The model predicts 2.31 million kg (heads-off weight) annual harvest, 1963-1971, while actual data indicate a 2.22 million kg annual harvest during this period. Almost 80% of the harvest is composed of shrimp in 44-66 and 67-110 tails/kg size classes. Total weight of each size class landed generally increases from the bay to successively deeper offshore areas. The harvest is highly seasonal; 94% of landings occurs May-October. Gross fishery revenue is $41 million and annual rent is $4.2 million. Model results imply that some management alternatives such as doubling nominal days fished may increase total harvest; however, marginal fishing costs increase at a relatively higher rate, reducing rent to the fishery. Sensitivity analysis emphasizes the need for better information on shrimp growth and natural mortality and on the proportion of the population which is actually subjected to fishing pressure. (Danovich-Wisconsin)
W80-03845

EMPLOYMENT IN THE FISHING INDUSTRY: SOME PRELIMINARY FINDINGS ON FISHERMEN'S MOBILITY,
For primary bibliographic entry see Field 6F.
W80-03856

V
1
3
/
1
1
J
E
1
8
0
MI

SUBJECT INDEX

2

Dynamics and Behavioral Toxicology of Aqua-Kleen (Trade Name) (2,4-D Butoxyethanol Ester) as Revealed by the Modification of Rheotropism in Rainbow Trout,
W80-03703 5A

200 MILE EXCLUSIVE ECONOMIC ZONES

Multinational Corporations, Nation-States and Ocean Resource Management: The Impact of the World's 200-Mile Economic Zone on Multinational and National Development,
W80-03859 6E

ABSORPTION

The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

The Absorption of DDT by Vascular Aquatic Plants,
W80-03663 5B

Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

Measured and Approximate Flux-Concentration Relations for Absorption of Water by Soil,
W80-03721 2G

Photosynthesis in the Aquatic Macrophyte Egeria Densa. III Gas Exchange Studies,
W80-03806 5C

ABSTRACTS

Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

ACARTIA

Effects of Temperature and Salinity on Production and Hatching of Dormant Eggs of Acartia Californiensis (Copepoda) in an Oregon Estuary,
W80-03700 5A

ACCLIMATION

The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

ACETIC ACID

Variation in the Reactions of Daphnia Magna Straus to the Effect of a Toxicant as Related to Its Delivery Regime,
W80-03676 5A

ACID RAIN

Effects of Artificial Acid Rain on Microbial Activity and Biomass,
W80-03688 5C

ACIDIC SOILS

Effects of Artificial Acid Rain on Microbial Activity and Biomass,
W80-03688 5C

ACIDIC WATER

Effects of Artificial Acid Rain on Microbial Activity and Biomass,
W80-03688 5C

ACIDS

Studies on the Effects of Acidic Medium on the Fry of Cyprinus Carpio,
W80-03706 5A

Effect of Benzoate on Microbial Decomposition of Fulvic Acids in Tjeukemeer (The Netherlands),
W80-03893 2K

ACTIVATED SLUDGE

The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

ADAPTATION

The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

Adaptive Economics and Natural Resources Policy,
W80-03854 6B

ADSORPTION

Adsorption-Desorption of Diuron by Freshwater Sediments,
W80-03838 5B

AEROSOLS

Trace Element Loading of Southern Lake Michigan by Dry Deposition of Atmospheric Aerosol,
W80-03621 5B

AGRICULTURAL WATERSHEDS

Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

AGRICULTURE

Methods of Estimating Some Possible Interactions of Agricultural Development and Water Resources in Alaska,
W80-03711 2A

A Cultural Resource Survey of the Teton Replacement Farmland, Jefferson County, Idaho,
W80-03778 6B

AIR POLLUTION

Incidents of Elevated Nitrate in Southern Ontario,
W80-03623 5B

ALABAMA

Effect of Tillage on Soil-Water Movement During Corn Growth,
W80-03724 2G

ALASKA

Determination of Selected Hydraulic Properties of Subarctic Soils,
W80-03648 2G

Hydrologic Role of Shallow Organic Soils in Cold Climates,
W80-03649 2G

Snowmelt Infiltration Into Seasonally Frozen Soils,
W80-03650 2G

Methods of Estimating Some Possible Interactions of Agricultural Development and Water Resources in Alaska,
W80-03711 2A

Water Resources Data for Alaska, Water Year 1978.
W80-03753 7C

ALGAE

Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

ALKALINE SOILS

Reclamation of Saline-Sodic Soils by Leaching,
W80-03723 2G

ANAEROBIC CONDITIONS

Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

Microbial Methanogenesis and Acetate Metabolism in a Meromictic Lake,
W80-03813 2H

ANAESTHETICS

The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

ANALYSIS

Does Precipitation Pattern Foretell Gujarat Climate Becoming Arid,
W80-03638 2B

ANALYTICAL TECHNIQUES

Comparison of Various Methods for Estimating the Quality of Water Based on Bottom-Dwelling Indicator Invertebrates,
W80-03673 5A

A Method for Studying the Excretory Function of Fish Kidneys Under Chronic Experimental Conditions,
W80-03675 5A

A Technique for Estimating Heights Reached by the 100-Year Flood on Unregulated, Nontidal Streams in North Carolina,
W80-03764 2E

Two Electivity Indices for Feeding with Special Reference to Zooplankton Grazing,
W80-03810 5C

Assessment of Aquatic Weed Problems,
W80-03826 4A

Formulating Aquatic Weed Management Programs,
W80-03841 4A

Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues,
W80-03847 6B

ANIMAL BEHAVIOR

Carnivorous Feeding Behavior of the Adult Calanoid Copepod Acartia Tonsa Dana,
W80-03783 5C

ANTHROPOLOGY

Systems Ecology, People Ecology, and the Anthropology of Fishing Communities,
W80-03860 6B

APPLICATION EQUIPMENT

Flow Control Devices Particularly Useful for Drip Irrigation,
W80-03604 3F

AQUA-KLEEN (TRADE NAME)

Dynamics and Behavioral Toxicology of Aqua-Kleen (Trade Name) (2,4-D Butoxyethanol

AQUA-KLEEN (TRADE NAME)

Ester) as Revealed by the Modification of Rheotropism in Rainbow Trout,
W80-03703 5A

AQUATIC ALGAE
Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

AQUATIC ANIMALS
Distribution of Macrofauna on a Malayan Mangrove Shore,
W80-03870 2I

Legal and Institutional Factors Affecting Mariculture in Texas,
W80-03873 6E

AQUATIC DRIFT
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

AQUATIC LIFE
Algal Growth Potential--Lower Willamette River, Oregon,
W80-03614 5B

A Review of the Lethal and Sub-Lethal Effects of Mercury on Aquatic Life,
W80-03683 5A

Investigations on the Effects of Domestic Sewage on the Benthic Ecosystem of Marine Intertidal Flats (In German),
W80-03684 5C

AQUATIC PLANTS
Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

AQUATIC WEED CONTROL
Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

Assessment of Aquatic Weed Problems,
W80-03826 4A

A New Approach for Salvinia Control,
W80-03827 4A

The Use of Multiple Inversion and Clean-Flo Lake Cleanser in Controlling Aquatic Plants,
W80-03828 4A

Establishment of Waterhyacinth Weevil Populations in Louisiana,
W80-03829 4A

Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

Taxonomic Characteristics of Aquatic Plants from the Alimentary Tract of Grass Carp,
W80-03831 4A

Effects of Mechanical Cutting on Submersed Vegetation in a Louisiana Lake,
W80-03832 4A

Mechanical Hydrilla Control in Orange Lake, Florida,
W80-03833 4A

Formulating Aquatic Weed Management Programs,
W80-03841 4A

AQUATIC WEEDS
Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

AQUIFER CHARACTERISTICS
Geohydrologic Model of the Floridan Aquifer in the Southwest Florida Water Management District,
W80-03751 2F

Ground Water in the San Juan Basin, New Mexico and Colorado,
W80-03763 2F

Ground-Water Resources of Grant and Sioux Counties, North Dakota,
W80-03767 2F

AQUIFER MANAGEMENT
The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

Geohydrologic Model of the Floridan Aquifer in the Southwest Florida Water Management District,
W80-03751 2F

Development of Ground Water in the Houston District, Texas, 1970-74,
W80-03768 4B

AQUIFERS
Preparation of Friable Aquiferous Specimens,
W80-03719 8E

Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

ARCHAEOLOGY
A Cultural Resource Survey of the Teton Replacement Farmland, Jefferson County, Idaho,
W80-03778 6B

ARCHITECTURE
Residential Water Reuse,
W80-03640 3D

ARCTIC
Canadian-American Relations in the Arctic: The Effect of Environmental Influences Upon Territorial Claims,
W80-03852 6E

An Overview of Offshore Environmental Pollution Laws and Regulations in Canada, Greenland, and the North Sea,
W80-03896 5C

Sources and Characteristics of Liquid Process Wastes from Arctic Offshore Hydrocarbon Exploration,
W80-03898 5C

ARGOPECTEN
Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

ARIZONA
Geophysical and Hydrologic Prediction of Fissuring and Land Subsidence, South-Central Arizona,
W80-03710 6A

ARKANSAS
Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

ARSENIC
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

ARSENIC COMPOUNDS
The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

ARTESIAN AQUIFERS
Paul Spring: An Investigation of Recharge in the Roswell (NM) Artesian Basin,
W80-03642 2F

ARTIFICIAL SUBSTRATES
A Periphyton Growth Substrate Useful for Nutrient Impact Studies in Large Rivers,
W80-03665 5A

The Microdistribution of Epiphytes on the Leaves of Natural and Artificial Macrophytes,
W80-03798 5C

ASIA
The Ecology of Sandy Beaches in Penang, Malaysia, with Special Reference to Excirolana Orientalis (Dana),
W80-03633 2L

ATTENUATION
Phytoplankton Distribution and Light Attenuation in Port Hacking Estuary,
W80-03799 5C

AUSTRALIA
Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

Wetlands of the South-West of Western Australia with Special Reference to the Busselton Area.
W80-03861 2L

AYU
Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

BACTERIA
An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica,
W80-03897 5C

BACTERICIDES
Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

BASELINE STUDIES
Composition and Abundance of Phytoplankton in Tributaries of the Lower Colorado River, Grand Canyon Region,
W80-03890 5C

BASIC DATA COLLECTIONS
Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78,
W80-03769 2F

Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

BEACHES
Surf Zone Dynamics During Upwelling on the Oregon Coast,
W80-03632 2L

The Ecology of Sandy Beaches in Penang, Malaysia, with Special Reference to Excirolana Orientalis (Dana),
W80-03633 2L

BED LOAD
A Reexamination of Bagnold's Granular-Fluid Model and Bed Load Transport Equation,
W80-03625 2J

BEDS
Damping of Gravity Waves over Porous Bed,
W80-03716 8B

BEHAVIOR
Systems Ecology, People Ecology, and the Anthropology of Fishing Communities,
W80-03860 6B

BENEFICIAL USE
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

BENEFITS
Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues,
W80-03847 6B

BENTHIC FAUNA
Particle Reworking in Sediments from the New York Bight Apex: Evidence from 234Th/238U Disequilibrium,
W80-03629 2J

The Effects of Oyster Shell Dredging on an Estuarine Benthic Community,
W80-03734 2L

BENTHIC FLORA
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

BENZOTHIOPHENES
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

BERMUDA
Hydrology of Small Oceanic Islands--Utility of an Estimate of Recharge Inferred from the Chloride Concentration of the Freshwater Lenses,
W80-03729 2F

BHAGIRATHI RIVER (INDIA)
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

BIBLIOGRAPHIES
Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

BIOACCUMULATION
The Absorption of DDT by Vascular Aquatic Plants,
W80-03663 5B

Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

Pesticides and Aquatic Ecosystems,
W80-03699 5C

BIOASSAY
An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

Variation in the Reactions of Daphnia Magna Straus to the Effect of a Toxicant as Related to Its Delivery Regime,
W80-03676 5A

BIOAVAILABILITY
A Review of the Lethal and Sub-Lethal Effects of Mercury on Aquatic Life,
W80-03683 5A

BIOCHEMICAL OXYGEN DEMAND
Dissolved Oxygen and Biochemical Oxygen Demand,
W80-03612 5A

BIOCONTROL
Establishment of Waterhyacinth Weevil Populations in Louisiana,
W80-03829 4A

Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

BIOINDICATORS
Comparison of Various Methods for Estimating the Quality of Water Based on Bottom-Dwelling Indicator Invertebrates,
W80-03673 5A

Zooplankters as Bioindicators of Water Quality,
W80-03678 5C

BIOLOGICAL COMMUNITIES
The Ecology of Sandy Beaches in Penang, Malaysia, with Special Reference to Excirolana Orientalis (Dana),
W80-03633 2L

The Sublittoral Ecology of the Menai Strait, I. Temporal and Spatial Variation in the Fauna and Flora Along a Transect,
W80-03634 2L

Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

The Effects of Oyster Shell Dredging on an Estuarine Benthic Community,
W80-03734 2L

Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure,
W80-03815 5A

Comparison of the Assemblages of Sap-Feeding Insects (Homoptera-Hemiptera) Inhabiting Two Structurally Different Salt Marsh Grasses in the Genus Spartina,
W80-03881 2I

BIOLOGICAL TREATMENT
Nitrification-Denitrification of Wastewater,
W80-03610 5D

BIOLUMINESCENCE
Effects of Dinoflagellate Bioluminescence on the Ingestion Rates of Herbivorous Zooplankton,
W80-03782 5C

BIOMASS
Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

BIOPHOTOLYSIS
Nitrogen Fixation by Thermophilic Blue-Green Algae (Cyanobacteria): Temperature Characteristics and Potential Use in Biophotolysis,
W80-03796 5F

BIOTRANSFORMATION
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

BIRDS
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

BLACK BAYOU LAKE (LA)
Effects of Mechanical Cutting on Submersed Vegetation in a Louisiana Lake,
W80-03832 4A

BLENNIUS
The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

BOGS
A Lowland Vegetation Sequence in South Westland: Pakihi Bog to Mixed Beech-Podocarp Forest. Part 1: The Principal Strata,
W80-03867 2I

Age, Origin, and Palaeo-Ecological Evidence of Blanket Bogs in Nord-Trondelag, Norway,
W80-03868 2J

Diatom Floristics and Succession in a Peat Bog Near Lily Lake, Summit County, Utah,
W80-03872 2H

Phytosociological Studies of Uryu-Numa Mire Studies of Upland Bog Vegetation in Hokkaido (II), (In Japanese),
W80-03874 2I

BOULDER COUNTY (COLO)
Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

BOUNDARIES (SURFACES)
Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

BOUNDARY LAYERS
Flow Visualization in Complex Turbulent Flows,
W80-03715 8B

BRACKISH WATER
An Evaluation of Marginal Waters as a Natural Resource in Israel,
W80-03742 3C

Low Pressure Brackish Water Reverse Osmosis Membrane Development - Final Report,
W80-03749 3A

BUBBLES
Air Bubbles in a Convectively Accelerated Water Flow,
W80-03740 8B

CADMIUM
The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica,
W80-03897 5C

CALIFORNIA
Proceedings of the Twelfth Biennial Conference on Groundwater, Sacramento, September 20-21, 1979.
W80-03641 4B

Index to Sources of Hydrologic Data,
W80-03744 7C

Reborn Federalism in Western Water Law: The New Melones Dam Decision,
W80-03795 6E

Breathing New Life into Section 8 of the 1902 Reclamation Act: California V. United States,
W80-03814 6E

State Control Over Federal Reclamation Projects,
W80-03823 6E

Owner Eligibility Restrictions - Acreage and Residency,
W80-03883 6E

'One Person, One Vote' and California's Water Districts,
W80-03886 6E

Litigation of the Reclamation Law in the Imperial Valley: Who Has Standing to Challenge Which Law,
W80-03888 3F

CANADA
Incidents of Elevated Nitrate in Southern Ontario,
W80-03623 5B

Canadian-American Relations in the Arctic: The Effect of Environmental Influences Upon Territorial Claims,
W80-03852 6E

CANADA GOOSE
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

CARBONATE ROCKS
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

CARP
Eye Damage to the Grass Carp (Ctenopharyngodon Idella) from Chronic Uptake of Strontium 90,
W80-03697 5C

Studies on the Effects of Acidic Medium on the Fry of Cyprinus Carpio,
W80-03706 5A

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

Taxonomic Characteristics of Aquatic Plants from the Alimentary Tract of Grass Carp,
W80-03831 4A

CHANNA
In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

CHANNEL FLOW
Tidal Hydraulics in Estuarine Channels,
W80-03714 2L

CHANNEL MORPHOLOGY
Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

Erosional Aspects of Managing Urban Streams,
W80-03773 2J

CHANNELS
Hydraulics of a Large Channel Paved with Boulders,
W80-03741 2E

CHARA
Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

CHATTAHOOCHEE RIVER BASIN (GA)
River-Quality Assessments.
W80-03606 5B

An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

CHATTAHOOCHEE RIVER (GA)
Thermal Modeling of Highly Transient Flows in the Chattahoochee River Near Atlanta, Georgia,
W80-03615 2E

CHEMICAL ANALYSIS
Quantitative Extraction of Chlorinated Organic Pesticides and Polychlorinated Biphenyls from Fish Organs and Tissues,
W80-03674 5A

CHEMICAL PROCESSES
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

CHEMICAL PROPERTIES
Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

CHEMICAL REACTIONS
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

CHESAPEAKE BAY
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

Recent Geochemical History of Flood Deposits in the Northern Chesapeake Bay,
W80-03735 2J

Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

Chesapeake Bay Future Conditions Report. Appendix 3. Economic and Social Profile.
W80-03844 6B

CHLORINE
The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

CHLOROPHYLL
Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

CHRISTIANA RIVER (DEL)
Contributions of Urban Land Use to Stream Water Quality,
W80-03644 5B

CHROMIUM
The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

CHRYSOPHYTA
Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter,
W80-03804 5C

CLAMS
Rangia Cuneata in An Industrial Water System (Bivalvia: Mactridae),
W80-03669 5A

CLASSIFICATION
Taxonomic Characteristics of Aquatic Plants from the Alimentary Tract of Grass Carp,
W80-03831 4A

Stream Types in Idaho: An Approach to Classification of Streams in Natural Areas,
W80-03835 6B

COASTAL MARSHES
Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands),
W80-03819 5C

COASTAL PLAINS
Water Resource Policies and Authorities: Federal Participation in Shore, Hurricane, Tidal and Lake Flood Protection (Final Rule).
W80-03877 6E

COASTS
Surf Zone Dynamics During Upwelling on the Oregon Coast,
W80-03632 2L

Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

COD
The Relationship Between Vertebral Number and Water Temperature in Cod,
W80-03680 5A

COLD REGIONS
Determination of Selected Hydraulic Properties of Subarctic Soils,
W80-03648 2G

COLIFORMS
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

COLONIZATION
Experimental Ecology with Particular Reference to Proposed Commercial Harvesting of Durvillaea (Phaeophyta, Durvilleales) in New Zealand,
W80-03802 2I

COLORADO
River-Quality Assessments.
W80-03606 5B

Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

A Review of New Colorado Water and Air Pollution Legislation,
W80-03668 6E

Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

COLORADO RIVER
Composition and Abundance of Phytoplankton in Tributaries of the Lower Colorado River, Grand Canyon Region,
W80-03890 5C

COLUMBIA RIVER
Turbulence Measurements in the Boundary Layer Over a Sand Wave Field,
W80-03626 2E

Effects of Dams and Impoundments on Migrations of Juvenile Chinook Salmon and Steelhead from the Snake River, 1966 to 1975,
W80-03701 5A

COMBINED SEWERS
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

Combined Sewer Overflow Treatment by Screening and Terminal Ponding -- Fort Wayne, Indiana,
W80-03656 5D

Level III: Receiving Water Quality Modeling for Urban Stormwater Management,
W80-03657 5D

COMMERCIAL FISHING
A Bioeconomic Model of the Gulf of Mexico Shrimp Fishery,
W80-03845 8I

Employment in the Fishing Industry: Some Preliminary Findings on Fishermen's Mobility,
W80-03856 6F

Fishermen's Remuneration Systems and Implications for Fisheries Development,
W80-03858 6C

Systems Ecology, People Ecology, and the Anthropology of Fishing Communities,
W80-03860 6B

COMPACTED SOILS
Infiltration of Soils as Affected by the Pressure and Water Content at the Time of Compaction,
W80-03722 2G

Influence of a Compact Zone on Solute Transport During Infiltration of Water,
W80-03727 2G

COMPARATIVE COSTS
Technical and Economic Assessment of Solar Distillation for Large Scale Production in Fresh Water.
W80-03842 3A

COMPUTER PROGRAMS
Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

CONFERENCES
River-Quality Assessments.
W80-03606 5B

CONNECTICUT
Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

CONSTITUTIONAL LAW
The Federal Reserved Rights Doctrine - from 1866 Through Eagle County,
W80-03777 6E

'One Person, One Vote' and California's Water Districts,
W80-03886 6E

CONTINENTAL SHELF
The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

CONTINENTAL SLOPE
Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

COPEPODS
Effects of Temperature and Salinity on Production and Hatching of Dormant Eggs of Acartia Californiensis (Copepoda) in an Oregon Estuary,
W80-03700 5A

Effects of Dinoflagellate Bioluminescence on the Ingestion Rates of Herbivorous Zooplankton,
W80-03782 5C

Carnivorous Feeding Behavior of the Adult Calanoid Copepod Acartia Tonsa Dana,
W80-03783 5C

COPPER
Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

CORES
Particle Reworking in Sediments from the New York Bight Apex: Evidence from 234Th/238U Disequilibrium,
W80-03629 2J

CORN (FIELD)
Effect of Tillage on Soil-Water Movement During Corn Growth,
W80-03724 2G

Soil and Water Losses from Corn-Soybean Rotations,
W80-03725 2J

COST ANALYSIS
Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

COST-BENEFIT ANALYSIS
Guidelines for Socioeconomic Impact Analyses of Environmental Regulations,
W80-03602 6C

Formulating Aquatic Weed Management Programs,
W80-03841 4A

COST-EFFECTIVENESS
Formulating Aquatic Weed Management Programs,
W80-03841 4A

COSTS
Environmental Quality and Economic Development,
W80-03857 6E

CROPS
On the Assessment of Crop Droughts: A Case Study for Disa (Gujarat),
W80-03637 2B

Effect of Tillage on Soil-Water Movement During Corn Growth,
W80-03724 2G

Soil and Water Losses from Corn-Soybean Rotations,
W80-03725 2J

CRUDE OIL
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

CRYSTAL LAKE (MN)
The Use of Multiple Inversion and Clean-Flo Lake Cleanser in Controlling Aquatic Plants,
W80-03828 4A

CULTIVATION
Effect of Tillage on Soil-Water Movement During Corn Growth,
W80-03724 2G

CULTURES
Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

CULVERTS
Erosional Aspects of Managing Urban Streams,
W80-03773 2J

CURRENTS (WATER)
The Sublittoral Ecology of the Menai Strait, I. Temporal and Spatial Variation in the Fauna and Flora Along a Transect,
W80-03634 2L

CYSTOSEIRA
Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

DAPHNIA
Variation in the Reactions of Daphnia Magna Straus to the Effect of a Toxicant as Related to Its Delivery Regime,
W80-03676 5A

DATA COLLECTIONS
Index to Sources of Hydrologic Data,
W80-03744 7C

Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

Assessment of Aquatic Weed Problems,
W80-03826 4A

DATA STORAGE AND RETRIEVAL
Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

DATING
A Cultural Resource Survey of the Teton Replacement Farmland, Jefferson County, Idaho,
W80-03778 6B

DDT
The Absorption of DDT by Vascular Aquatic Plants,
W80-03663 5B

DDVP
Pesticides and Aquatic Ecosystems,
W80-03699 5C

DECISION MAKING
River-Quality Assessment: Concept, Framework, and Application in the Willamette River Basin, Oregon,
W80-03608 6B

Estimating Willingness to Pay: Why and How.,
W80-03846 6B

Adaptive Economics and Natural Resources Policy,
W80-03854 6B

DECISION-MAKING CRITERIA
Guidelines for Socioeconomic Impact Analyses of Environmental Regulations,
W80-03602 6C

DEMAND
Estimating Willingness to Pay: Why and How.,
W80-03846 6B

DENSITY
Zooplankton in a Quasi-Stable Phase in an Endorheic Lake (Lake Chilwa, Malawi),
W80-03807 5C

DESALINATION
Low Pressure Brackish Water Reverse Osmosis Membrane Development - Final Report,
W80-03749 3A

Design of an Indirect Freezing Process Pilot Plant Based on Bulk Crystallization,
W80-03772 3A

DESALINATION PLANTS
Technical and Economic Assessment of Solar Distillation for Large Scale Production in Fresh Water.
W80-03842 3A

DESALINATION PROCESSES
Technical and Economic Assessment of Solar Distillation for Large Scale Production in Fresh Water.
W80-03842 3A

DESTRATIFICATION
Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

The Use of Multiple Inversion and Clean-Flo Lake Cleanser in Controlling Aquatic Plants,
W80-03828 4A

DEVELOPING COUNTRIES
The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

Multinational Corporations, Nation-States and Ocean Resource Management: The Impact of the World's 200-Mile Economic Zone on Multinational and National Development,
W80-03859 6E

DIATOMS
Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

Species Composition and Seasonal Occurence of Centric Diatoms in a Polluted Marine Environment,
W80-03820 5C

DIBENZOTHIOPHENES
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

DIFFUSERS
Staged Multiport Diffusers,
W80-03717 5B

DIFFUSION
Staged Multiport Diffusers,
W80-03717 5B

Sediments Suspended in Stream Flow,
W80-03718 2J

DIGESTION
Taxonomic Characteristics of Aquatic Plants from the Alimentary Tract of Grass Carp,
W80-03831 4A

DINOFLAGELLATES
Effects of Dinoflagellate Bioluminescence on the Ingestion Rates of Herbivorous Zooplankton,
W80-03782 5C

DISINFECTION
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

Comparison of Ozone Contactors for Municipal Wastewater Effluent Disinfection -- Packed Column Versus Jet Scrubber,
W80-03653 5D

Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

DISPERSION
Verifying Lake Transport Models with Special Statistics,
W80-03836 2H

DISSOLVED OXYGEN
Fish Mortality and Fishing During an Unprecedented Draught in Lake Pichhola, Udaipur,
W80-03698 2H

DISTILLATION
Technical and Economic Assessment of Solar Distillation for Large Scale Production in Fresh Water.
W80-03842 3A

DISTRIBUTION
Flow in the Sea of Heavy Metals from a Smelter Industry,
W80-03788 5B

The Distribution of Algal Epiphytes on Macrophyte Hosts Offshore from La Parguera, Puerto Rico,
W80-03797 5C

The Microdistribution of Epiphytes on the Leaves of Natural and Artificial Macrophytes,
W80-03798 5C

Phytoplankton Distribution and Light Attenuation in Port Hacking Estuary,
W80-03799 5C

Zooplankton in a Quasi-Stable Phase in an Endorheic Lake (Lake Chilwa, Malawi),
W80-03807 5C

DISTRIBUTION PATTERNS
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

A Lowland Vegetation Sequence in South Westland: Pakihi Bog to Mixed Beech-Podocarp Forest. Part 1: The Principal Strata,
W80-03867 2I

Distribution of Macrofauna on a Malayan Mangrove Shore,
W80-03870 2I

Factors Affecting Tissue Nutrient Concentrations in a Scirpus-Equisetum Wetland,
W80-03876 2I

Pattern and Diversity in Swamp and Dune Vegetation, North Stradbroke Island,
W80-03882 2I

DOMESTIC USE
Residential Water Reuse,
W80-03640 3D

V 1 3 / 1 1 1 J E 1 8 0 UMI

DOMESTIC WASTES
Residential Water Reuse,
W80-03640 3D

Characteristics of Effluents from Gray and Black Water Septic Tanks,
W80-03791 5B

DOMINANT ORGANISMS
The Effect of the Degree of Mineralization of Water on Phytoplankton,
W80-03664 5A

The Distribution and Ecology of the Naididae (Oligochaeta) Which Inhabit the Filter-Beds of Sewage-Works in Britain,
W80-03666 5C

DORMANCY
Effects of Temperature and Salinity on Production and Hatching of Dormant Eggs of Acartia Californiensis (Copepoda) in an Oregon Estuary,
W80-03700 5A

DRAWDOWN
Development of Ground Water in the Houston District, Texas, 1970-74,
W80-03768 4B

DREDGING
Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations,
W80-03631 2J

The Effects of Oyster Shell Dredging on an Estuarine Benthic Community,
W80-03734 2L

DROUGHTS
Statistical Analysis of Hydrologic Critical Droughts,
W80-03618 2E

On the Assessment of Crop Droughts: A Case Study for Disa (Gujarat),
W80-03637 2B

Fish Mortality and Fishing During an Unprecedented Draught in Lake Pichhola, Udaipur,
W80-03698 2H

Impacts of the Western Drought on the Regional Electricity Situation.
W80-03843 6D

DUNES
Pattern and Diversity in Swamp and Dune Vegetation, North Stradbroke Island,
W80-03882 2I

ECOLOGICAL DISTRIBUTION
The Ecology of a Saltmarsh in Sri Lanka,
W80-03871 2I

ECOLOGY
The Ecology of a Saltmarsh in Sri Lanka,
W80-03871 2I

ECONOMIC ANALYSIS
Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

ECONOMIC EFFICIENCY
Pigovian Taxes, Polluter Subsidies, Regulation, and the Size of a Polluting Industry,
W80-03848 6E

What Can We Get From Effluent Charges,
W80-03849 6B

The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

ECONOMICS
The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

Formulating Aquatic Weed Management Programs,
W80-03841 4A

A Bioeconomic Model of the Gulf of Mexico Shrimp Fishery,
W80-03845 8I

The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

Adaptive Economics and Natural Resources Policy,
W80-03854 6B

Environmental Management in General Equilibrium: A New Incentive Compatible Approach,
W80-03855 6B

Environmental Quality and Economic Development,
W80-03857 6E

Systems Ecology, People Ecology, and the Anthropology of Fishing Communities,
W80-03860 6B

ECOSYSTEMS
Pesticides and Aquatic Ecosystems,
W80-03699 5C

Very Simple Model of the Initial Stage of Oligotrophic-Eutrophic Succession. In Bodies of Water,
W80-03792 5A

Incorporation, Distribution and Fate of Saturated Petroleum Hydrocarbons in Sediments from a Controlled Marine Ecosystem,
W80-03899 5C

ECOTYPES
Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure,
W80-03815 5A

EDTA
In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

EELGRASS
Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands),
W80-03819 5C

EELS
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

EFFECTS
The Effects of Oyster Shell Dredging on an Estuarine Benthic Community,
W80-03734 2L

EFFLUENTS
Staged Multiport Diffusers,
W80-03717 5B

Characteristics of Effluents from Gray and Black Water Septic Tanks,
W80-03791 5B

What Can We Get From Effluent Charges,
W80-03849 6B

EGERIA DENSA
Photosynthesis in the Aquatic Macrophyte Egeria Densa. III Gas Exchange Studies,
W80-03806 5C

ELECTROMAGNETIC VELOCITY METER
Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

ELECTRON MICROSCOPY
Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

EMERGENT PLANTS
The Nutritional Ecology of Cyperus Esculentus, an Emergent Aquatic Plant, Grown on Different Sediments,
W80-03786 2I

ENERGY
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

ENERGY CONVERSION
Photosynthetically Active Radiation in a Stand of Phragmites Communis Trin. II. Model of Light Extinction in the Stand,
W80-03869 2H

ENVIRONMENT
Environmental Protection for Whom,
W80-03853 6B

Environmental Management in General Equilibrium: A New Incentive Compatible Approach,
W80-03855 6B

ENVIRONMENTAL CONTROL
Environmental Quality and Economic Development,
W80-03857 6E

ENVIRONMENTAL EFFECTS
Methods of Estimating Some Possible Interactions of Agricultural Development and Water Resources in Alaska,
W80-03711 2A

Erosional Aspects of Managing Urban Streams,
W80-03773 2J

Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica,
W80-03897 5C

ENZYMES
In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

EPIPHYTIC ALGAE
Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

EPIPHYTOLOGY
The Distribution of Algal Epiphytes on Macrophyte Hosts Offshore from La Parguera, Puerto Rico,
W80-03797 5C

The Microdistribution of Epiphytes on the Leaves of Natural and Artificial Macrophytes,
W80-03798 5C

A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

EPIZOOTIOLOGY
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

EQUIPMENT
A Rainfall Simulator with Nonrepetitious Movement of Drop Outlets,
W80-03726 2B

The Design and Use of an Oscillating Trolley Wave-Simulator, for Installation in Unidirectional Flow Flumes,
W80-03737 2L

EROSION
Erosion Potential Assessment for the Willamette River Basin, Oregon,
W80-03613 7C

Erosional Aspects of Managing Urban Streams,
W80-03773 2J

EROSION CONTROL
Erosional Aspects of Managing Urban Streams,
W80-03773 2J

ESTER DOME AREA (ALASKA)
Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

ESTIMATING
Estimating Willingness to Pay: Why and How.,
W80-03846 6B

ESTUARIES
On the Calculation of the Width Averaged Flow Due to Long Waves in an Open Channel,
W80-03619 2E

Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

Tidal Hydraulics in Estuarine Channels,
W80-03714 2L

Recent Geochemical History of Flood Deposits in the Northern Chesapeake Bay,
W80-03735 2J

Hydrochemistry of Dissolved Inorganic Carbon in the St. Lawrence Estuary (Canada),
W80-03736 2L

Incorporation, Distribution and Fate of Saturated Petroleum Hydrocarbons in Sediments from a Controlled Marine Ecosystem,
W80-03899 5C

ESTUARINE ENVIRONMENTS
Phytoplankton Distribution and Light Attenuation in Port Hacking Estuary,
W80-03799 5C

The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

Species Composition and Seasonal Occurence of Centric Diatoms in a Polluted Marine Environment,
W80-03820 5C

ESTUARING ENVIRONMENTS
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

EUPHOTIC ZONE
Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

EURASIAN WATERMILFOIL
British Columbia Aquatic Plant Management Program,
W80-03840 4A

EUTROPHICATION
Phosphrus Export from Rural Maine Watersheds,
W80-03776 5B

A Nine-Year Study of the Phytoplankton of the Eutrophic and Non-Stratifying Loch Leven (Kinross, Scotland),
W80-03816 5C

EVAPOTRANSPIRATION
On the Assessment of Crop Droughts: A Case Study for Disa (Gujarat),
W80-03637 2B

Measuring Evapotranspiration of Turfgrass,
W80-03646 2D

EXCREMENT
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

EXPLORATION
Sources and Characteristics of Liquid Process Wastes from Arctic Offshore Hydrocarbon Exploration,
W80-03898 5C

FAULTS (GEOLOGIC)
Structural Controls of Hot-Spring Systems in Southwestern Montana,
W80-03760 1A

FEDERAL JURISDICTION
The Federal Reserved Rights Doctrine - from 1866 Through Eagle County,
W80-03777 6E

FEDERAL RECLAMATION LAW
Reborn Federalism in Western Water Law: The New Melones Dam Decision,
W80-03795 6E

Breathing New Life into Section 8 of the 1902 Reclamation Act: California V. United States,
W80-03814 6E

State Control Over Federal Reclamation Projects,
W80-03823 6E

Owner Eligibility Restrictions - Acreage and Residency,
W80-03883 6E

Litigation of the Reclamation Law in the Imperial Valley: Who Has Standing to Challenge Which Law,
W80-03888 3F

FEDERAL-STATE WATER RIGHTS CONFLICT
The Federal Reserved Rights Doctrine - from 1866 Through Eagle County,
W80-03777 6E

FEDERAL-STATE WATER RIGHTS CONFLICTS
Public Water Supplies: The Effect of Federal and Tennessee Water Resource Law,
W80-03601 6E

Reborn Federalism in Western Water Law: The New Melones Dam Decision,
W80-03795 6E

Breathing New Life into Section 8 of the 1902 Reclamation Act: California V. United States,
W80-03814 6E

State Control Over Federal Reclamation Projects,
W80-03823 6E

FEDERAL WATER POLLUTION CONTROL ACT
Liability for Oil Pollution - United States Law,
W80-03667 6E

Will Judicial Error Allow Industrial Point Sources to Avoid BPT and Perhaps BAT Later. A Story of Good Intentions, Bad Dictum, and Ugly Consequences,
W80-03885 6E

FEEDS
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

FINANCIAL FEASIBILITY
Financial Statement Modeling: Analyzing the Pollution-Control Tax Incentive,
W80-03850 6B

FISH BARRIERS
Effects of Dams and Impoundments on Migrations of Juvenile Chinook Salmon and Steelhead from the Snake River, 1966 to 1975,
W80-03701 5A

FISH DISEASES
Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

Eye Damage to the Grass Carp (Ctenopharyngodon Idella) from Chronic Uptake of Strontium 90,
W80-03697 5C

FISH ESTABLISHMENT
Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

FISH KIDNEY FUNCTION
A Method for Studying the Excretory Function of Fish Kidneys Under Chronic Experimental Conditions,
W80-03675 5A

FISH MIGRATIONS
Effects of Dams and Impoundments on Migrations of Juvenile Chinook Salmon and Steelhead from the Snake River, 1966 to 1975,
W80-03701 5A

FISH PARASITES
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

FISH PHYSIOLOGY
A Method for Studying the Excretory Function of Fish Kidneys Under Chronic Experimental Conditions,
W80-03675 5A

The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

FISH POPULATIONS
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

FISH STOCKING
Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

FISHKILLS
Fish Mortality and Fishing During an Unprecedented Draught in Lake Pichhola, Udaipur, W80-03698 2H

FISSURES (GEOLOGIC)
Geophysical and Hydrologic Prediction of Fissuring and Land Subsidence, South-Central Arizona, W80-03710 6A

FJORDS
Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords, W80-03800 5C

FLOOD DAMAGE
A Cultural Resource Survey of the Teton Replacement Farmland, Jefferson County, Idaho, W80-03778 6B

FLOOD PROTECTION
Water Resource Policies and Authorities: Federal Participation in Shore, Hurricane, Tidal and Lake Flood Protection (Final Rule). W80-03877 6E

FLOOD ROUTING
A Generalized Approach to Kinematic Flood Routing, W80-03732 2E

FLOOD WAVES
A Generalized Approach to Kinematic Flood Routing, W80-03732 2E

FLOODS
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms, W80-03635 2B

Recent Geochemical History of Flood Deposits in the Northern Chesapeake Bay, W80-03735 2J

A Technique for Estimating Heights Reached by the 100-Year Flood on Unregulated, Nontidal Streams in North Carolina, W80-03764 2E

FLORIDA
The Effects of Oyster Shell Dredging on an Estuarine Benthic Community, W80-03734 2L

Water Resources Data for Florida, Water Year 1978--Volume 3A-1. Southwest Florida Surface Water. W80-03754 7C

Water Resources Data for Florida, Water Year 1978--Volume 3A-2. Southwest Florida Surface Water Quality. W80-03755 7C

Water Resources Data for Florida, Water Year 1978--Volume 3B. Southwest Florida Ground Water. W80-03756 7C

Surface-Water Features in Osceola County and Adjacent Areas, Florida, W80-03761 7C

Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida, W80-03766 7B

Holocene Sedimentation at Cape Sable, South Florida, W80-03864 2J

Comparative Biomass and Growth of Cypress in Florida Wetlands, W80-03866 2I

FLOTATION
Manganese Removal from Water by Flotation with Microgas Dispersions, W80-03748 5F

FLOW
Measurements of Combined Oscillatory and Steady Flow Over a Rough Bed, W80-03620 8B

Observations of Stratified Flow Past Three-Dimensional Barriers, W80-03624 8B

Air Bubbles in a Convectively Accelerated Water Flow, W80-03740 8B

FLOW AROUND OBJECTS
Observations of Stratified Flow Past Three-Dimensional Barriers, W80-03624 8B

FLOW CHARACTERISTICS
Hydraulics of Flow in the Kaskaskia River, Illinois, W80-03713 2E

Low-Flow Characteristics of Streams in the Pecatonica-Sugar River Basin, Wisconsin, W80-03765 2E

FLOW CONTROL
Flow Control Devices Particularly Useful for Drip Irrigation, W80-03604 3F

FLOW SEPARATION
Flow Visualization in Complex Turbulent Flows, W80-03715 8B

FLOW VISUALIZATION
Flow Visualization in Complex Turbulent Flows, W80-03715 8B

FLUCTUATIONS
Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes, W80-03660 5C

FLUMES
The Design and Use of an Oscillating Trolley Wave-Simulator, for Installation in Unidirectional Flow Flumes, W80-03737 2L

FLUORENE DERIVATIVES
Mutagenicity of Fluorene Derivatives: A Proposed Mechanism, W80-03745 5A

FLUORINE
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries, W80-03691 5B

FOOD CHAINS
Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish, W80-03686 5B

Two Electivity Indices for Feeding with Special Reference to Zooplankton Grazing, W80-03810 5C

Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands), W80-03819 5C

The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica, W80-03897 5C

FOOD HABITS
Carnivorous Feeding Behavior of the Adult Calanoid Copepod Acartia Tonsa Dana, W80-03783 5C

Two Electivity Indices for Feeding with Special Reference to Zooplankton Grazing, W80-03810 5C

Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure, W80-03815 5A

FORECASTING
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms, W80-03635 2B

Chesapeake Bay Future Conditions Report. Appendix 3. Economic and Social Profile. W80-03844 6B

FOREST
A Lowland Vegetation Sequence in South Westland: Pakihi Bog to Mixed Beech-Podocarp Forest. Part 1: The Principal Strata, W80-03867 2I

FREEZING
Design of an Indirect Freezing Process Pilot Plant Based on Bulk Crystallization, W80-03772 3A

FRONTS (OCEANIC)
The Islay Front: Physical Structure and Phytoplankton Distribution, W80-03733 2L

FROZEN SOILS
Snowmelt Infiltration Into Seasonally Frozen Soils, W80-03650 2G

FRY
Studies on the Effects of Acidic Medium on the Fry of Cyprinus Carpio, W80-03706 5A

GALVESTON BAY
A Bioeconomic Model of the Gulf of Mexico Shrimp Fishery, W80-03845 8I

GALVESTON COUNTY (TEX)
Development of Ground Water in the Houston District, Texas, 1970-74, W80-03768 4B

GEOCHEMISTRY
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel, W80-03728 2K

GEOLOGIC MAPPING
Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska, W80-03712 2K

GEOLOGY
Ground Water in the San Juan Basin, New Mexico and Colorado, W80-03763 2F

GEOMORPHOLOGY
The Geomorphologic Structure of Hydrologic Response, W80-03743 2A

GEORGIA
River-Quality Assessments. W80-03606 5B

An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia, W80-03609 5B

GEORGIA

Thermal Modeling of Highly Transient Flows in the Chattahoochee River Near Atlanta, Georgia, W80-03615 2E

GEOTHERMAL STUDIES
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel, W80-03728 2K

Structural Controls of Hot-Spring Systems in Southwestern Montana, W80-03760 1A

GEOTHERMOMETERS
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel, W80-03728 2K

GRAND CANYON (AR-UT)
Composition and Abundance of Phytoplankton in Tributaries of the Lower Colorado River, Grand Canyon Region, W80-03890 5C

GRANT COUNTY (N DAK)
Ground-Water Resources of Grant and Sioux Counties, North Dakota, W80-03767 2F

GRAVITY WAVES
Damping of Gravity Waves over Porous Bed, W80-03716 8B

GRAZING
Effects of Dinoflagellate Bioluminescence on the Ingestion Rates of Herbivorous Zooplankton, W80-03782 5C

Two Electivity Indices for Feeding with Special Reference to Zooplankton Grazing, W80-03810 5C

GREAT LAKES
Incidents of Elevated Nitrate in Southern Ontario, W80-03623 5B

GROUND-WATER RESOURCES
Geohydrologic Model of the Floridan Aquifer in the Southwest Florida Water Management District, W80-03751 2F

GROUNDWATER
Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains, W80-03636 2F

Proceedings of the Twelfth Biennial Conference on Groundwater, Sacramento, September 20-21, 1979. W80-03641 4B

Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)), W80-03731 2F

Water Resources Data for Indiana, Water Year 1978. W80-03752 7C

Water Resources Data for Alaska, Water Year 1978. W80-03753 7C

Water Resources Data for Florida, Water Year 1978--Volume 3B. Southwest Florida Ground Water. W80-03756 7C

Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado, W80-03757 2A

Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality, W80-03762 7C

Ground Water in the San Juan Basin, New Mexico and Colorado, W80-03763 2F

Development of Ground Water in the Houston District, Texas, 1970-74, W80-03768 4B

Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78, W80-03769 2F

GROUNDWATER AVAILABILITY
Proceedings of the Twelfth Biennial Conference on Groundwater, Sacramento, September 20-21, 1979. W80-03641 4B

GROUNDWATER BASINS
Proceedings of the Twelfth Biennial Conference on Groundwater, Sacramento, September 20-21, 1979. W80-03641 4B

GROUNDWATER MANAGEMENT
Proceedings of the Twelfth Biennial Conference on Groundwater, Sacramento, September 20-21, 1979. W80-03641 4B

GROUNDWATER MOVEMENT
Geohydrologic Model of the Floridan Aquifer in the Southwest Florida Water Management District, W80-03751 2F

GROUNDWATER POTENTIAL
Proceedings of the Twelfth Biennial Conference on Groundwater, Sacramento, September 20-21, 1979. W80-03641 4B

GROUNDWATER RECHARGE
Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains, W80-03636 2F

Proceedings of the Twelfth Biennial Conference on Groundwater, Sacramento, September 20-21, 1979. W80-03641 4B

Hydrology of Small Oceanic Islands--Utility of an Estimate of Recharge Inferred from the Chloride Concentration of the Freshwater Lenses, W80-03729 2F

GROUNDWATER RESOURCES
Proceedings of the Twelfth Biennial Conference on Groundwater, Sacramento, September 20-21, 1979. W80-03641 4B

Ground-Water Resources of Grant and Sioux Counties, North Dakota, W80-03767 2F

Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2, W80-03770 7C

GROWTH RATES
Dependence of the Time of Gamete Maturation and Spawning on Environmental Temperature in the Virginia Oyster Crassostrea Virginica, W80-03679 5C

The Relationship Between Vertebral Number and Water Temperature in Cod, W80-03680 5A

Phytomechanics--Plant Physiology and Applied Mechanics, W80-03780 2I

The Nutritional Ecology of Cyperus Esculentus, an Emergent Aquatic Plant, Grown on Different Sediments, W80-03786 2I

Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter, W80-03804 5C

GUJARAT STATE (INDIA)
Does Precipitation Pattern Foretell Gujarat Climate Becoming Arid, W80-03638 2B

GULF OF MEXICO
Some Aspects of the Oceanography of the Gulf of Mexico Using Satellite and in Situ Data, W80-03628 2L

HARBORS
Species Composition and Seasonal Occurence of Centric Diatoms in a Polluted Marine Environment, W80-03820 5C

HARRIS COUNTY (TEX)
Development of Ground Water in the Houston District, Texas, 1970-74, W80-03768 4B

HARVESTING
Experimental Ecology with Particular Reference to Proposed Commercial Harvesting of Durvillaea (Phaeophyta, Durvilleales) in New Zealand, W80-03802 2I

Effects of Mechanical Cutting on Submersed Vegetation in a Louisiana Lake, W80-03832 4A

Mechanical Hydrilla Control in Orange Lake, Florida, W80-03833 4A

HATCHING
Effects of Temperature and Salinity on Production and Hatching of Dormant Eggs of Acartia Californiensis (Copepoda) in an Oregon Estuary, W80-03700 5A

HEAT TRANSFER
An Analysis of the Irreversible Thermodynamics Model for Coupled Heat and Moisture Transport Phenomena in Unsaturated Porous Media, W80-03639 1A

HEATED WATER
Aeromonas Distribution and Survival in a Thermally Altered Lake, W80-03787 4A

HEAVY METALS
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries, W80-03691 5B

The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay, W80-03696 5A

The Influence of Urbanization of the Transport of Heavy Metals in New Jersey Streams, W80-03774 5B

Flow in the Sea of Heavy Metals from a Smelter Industry, W80-03788 5B

Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

Effects of Mine Drainage on the River Hayle, Cornwall (A) Factors Affecting Concentrations of Copper, Zinc and Iron in Water, Sediments and Dominant Invertebrate Fauna,
W80-03891 5C

HERBICIDES
Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

A New Approach for Salvinia Control,
W80-03827 4A

Adsorption-Desorption of Diuron by Freshwater Sediments,
W80-03838 5B

British Columbia Aquatic Plant Management Program,
W80-03840 4A

HEXACHLORANE
The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

HISTORY
Age, Origin, and Palaeo-Ecological Evidence of Blanket Bogs in Nord-Trondelag, Norway,
W80-03868 2J

Diatom Floristics and Succession in a Peat Bog Near Lily Lake, Summit County, Utah,
W80-03872 2H

HOSTS
The Distribution of Algal Epiphytes on Macrophyte Hosts Offshore from La Parguera, Puerto Rico,
W80-03797 5C

HOT SPRINGS
Structural Controls of Hot-Spring Systems in Southwestern Montana,
W80-03760 1A

HOUSTON DISTRICT
Development of Ground Water in the Houston District, Texas, 1970-74,
W80-03768 4B

HUMAN PATHOLOGY
Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

HYDRAULIC CONDUCTIVITY
Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

HYDRAULIC STRUCTURES
Hydraulics of Rectangular Vertical Drop Structures,
W80-03739 2E

HYDRODYNAMICS
Formulating Lake Models Which Preserve Spectral Statistics,
W80-03605 2H

Verifying Lake Transport Models with Special Statistics,
W80-03836 2H

HYDROELECTRIC POWER
Impacts of the Western Drought on the Regional Electricity Situation.
W80-03843 6D

HYDROGEOLOGY
Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

Ground Water in the San Juan Basin, New Mexico and Colorado,
W80-03763 2F

HYDROLOGIC ASPECTS
Toward a Conceptual Framework for River-Quality Trend and Cause-Effect Analysis,
W80-03611 5B

HYDROLOGIC DATA
Index to Sources of Hydrologic Data,
W80-03744 7C

Water Resources Data for Indiana, Water Year 1978.
W80-03752 7C

Water Resources Data for Alaska, Water Year 1978.
W80-03753 7C

Water Resources Data for Florida, Water Year 1978--Volume 3A-1. Southwest Florida Surface Water.
W80-03754 7C

Water Resources Data for Florida, Water Year 1978--Volume 3A-2. Southwest Florida Surface Water Quality.
W80-03755 7C

Water Resources Data for Florida, Water Year 1978--Volume 3B. Southwest Florida Ground Water.
W80-03756 7C

Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78,
W80-03769 2F

Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

Interim Progress Report Supplement a -- Data Analysis, SCPP Data Collection and Analysis for the Period 1 January 1979 Through 30 June 1979,
W80-03779 3B

HYDROLOGIC PROPERTIES
Surface-Water Features in Osceola County and Adjacent Areas, Florida,
W80-03761 7C

HYSTERESIS
A Hysteresis Model Based on an Explicit Domain-Dependence Function,
W80-03720 2G

IDAHO
A Cultural Resource Survey of the Teton Replacement Farmland, Jefferson County, Idaho,
W80-03778 6B

Stream Types in Idaho: An Approach to Classification of Streams in Natural Areas,
W80-03835 6B

ILLINOIS
Hydraulics of Flow in the Kaskaskia River, Illinois,
W80-03713 2E

IMPAIRED WATER USE
Residential Water Reuse,
W80-03640 3D

IMPOUNDED WATERS
Prediction of the Quality of Water in a Proposed Impoundment in Southwestern Wisconsin, USA,
W80-03801 5B

IMPOUNDMENTS
Prediction of the Quality of Water in a Proposed Impoundment in Southwestern Wisconsin, USA,
W80-03801 5B

INCOME DISTRIBUTION
Fishermen's Remuneration Systems and Implications for Fisheries Development,
W80-03858 6C

INDIA
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains,
W80-03636 2F

On the Assessment of Crop Droughts: A Case Study for Disa (Gujarat),
W80-03637 2B

Does Precipitation Pattern Foretell Gujarat Climate Becoming Arid,
W80-03638 2B

Fish Mortality and Fishing During an Unprecedented Draught in Lake Pichhola, Udaipur,
W80-03698 2H

INDIAN RESERVATIONS
Sale and Lease of Indian Water Rights,
W80-03880 6E

INDIAN RIVER (FL)
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

INDIANA
Water Resources Data for Indiana, Water Year 1978.
W80-03752 7C

INDUSTRIAL WASTES
Mutagens in a River Heavily Polluted with Paper Recycling Wastes: Results of Field and Laboratory Mutagen Assays,
W80-03746 5A

Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

INDUSTRIAL WATER
The Potential for Municipal Wastewater Reuse by Industry in Massachusetts,
W80-03747 3C

INFILTRATION
Snowmelt Infiltration Into Seasonally Frozen Soils,
W80-03650 2G

Infiltration of Soils as Affected by the Pressure and Water Content at the Time of Compaction,
W80-03722 2G

Influence of a Compact Zone on Solute Transport During Infiltration of Water,
W80-03727 2G

INFRARED GAS ANALYSIS
Photosynthesis in the Aquatic Macrophyte Egeria Densa. III Gas Exchange Studies,
W80-03806 5C

INHIBITION
In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

Effects of Temperature and Salinity on Production and Hatching of Dormant Eggs of Acartia Californiensis (Copepoda) in an Oregon Estuary,
W80-03700 5A

INLETS (WATERWAYS)
Submarine Slide-Generated Water Waves in Kitimat Inlet, British Columbia,
W80-03627 2L

INSECTICIDES
Behavior of Abate in Microorganisms Isolated from Polluted Water,
W80-03892 5F

Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

INSECTS
Comparison of the Assemblages of Sap-Feeding Insects (Homoptera-Hemiptera) Inhabiting Two Structurally Different Salt Marsh Grasses in the Genus Spartina,
W80-03881 2I

INSTITUTIONS
Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

INSTRUMENTATION
Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

INTERBASIN WATER TRANSFERS
An Interactive River Basin Water Management Model: Synthesis and Application,
W80-03708 6A

INTERFACES
On the Magnitude of Interfacial Shear of Subcritical Stratified Flows in Relation with Interfacial Stability,
W80-03738 2E

INTERNATIONAL COMMISSIONS
The Convention for the Prevention of Marine Pollution from Land-Based Sources: An Effective Method for Arbitrating International Effluent Pollution Disputes,
W80-03887 6E

INTERNATIONAL LAW
American Bar Association Resolution Re Natural Resources of the Sea Adopted by the House of Delegates, August 6, 1973 and Report of the Section of Natural Resources Law Recommending Adoption of the Resolution.
W80-03695 6E

The Convention for the Prevention of Marine Pollution from Land-Based Sources: An Effective Method for Arbitrating International Effluent Pollution Disputes,
W80-03887 6E

INTERNATIONAL WATERS
Canadian-American Relations in the Arctic: The Effect of Environmental Influences Upon Territorial Claims,
W80-03852 6E

INTERSTITIAL WATER
An Empirical Model for Physical Parameters of Recent Sedimentary Deposits of Lake Ekoln and Lake Vanern,
W80-03790 5A

INTERTIDAL AREAS
Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

INTERTIDAL ZONE
Holocene Sedimentation at Cape Sable, South Florida,
W80-03864 2J

INVERTEBRATES
Effects of Mine Drainage on the River Hayle, Cornwall (A) Factors Affecting Concentrations of Copper, Zinc and Iron in Water, Sediments and Dominant Invertebrate Fauna,
W80-03891 5C

INVESTMENT
Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

Financial Statement Modeling: Analyzing the Pollution-Control Tax Incentive,
W80-03850 6B

IRISH COAST
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

IRRIGATION
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

Flow Control Devices Particularly Useful for Drip Irrigation,
W80-03604 3F

The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

IRRIGATION CANALS
Hydraulics of Rectangular Vertical Drop Structures,
W80-03739 2E

Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

IRRIGATION PROGRAMS
Litigation of the Reclamation Law in the Imperial Valley: Who Has Standing to Challenge Which Law,
W80-03888 3F

ISLANDS
Hydrology of Small Oceanic Islands--Utility of an Estimate of Recharge Inferred from the Chloride Concentration of the Freshwater Lenses,
W80-03729 2F

ISOPODS
The Ecology of Sandy Beaches in Penang, Malaysia, with Special Reference to Excirolana Orientalis (Dana),
W80-03633 2L

Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands),
W80-03819 5C

ISRAEL
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

An Evaluation of Marginal Waters as a Natural Resource in Israel,
W80-03742 3C

JACKSON LAKE (FL)
Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

JAPAN
Phytosociological Studies of Uryu-Numa Mire Studies of Upland Bog Vegetation in Hokkaido (II), (In Japanese),
W80-03874 2I

JUDICIAL DECISIONS
State Control Over Federal Reclamation Projects,
W80-03823 6E

KARACHI
Species Composition and Seasonal Occurence of Centric Diatoms in a Polluted Marine Environment,
W80-03820 5C

KASKASKIA RIVER (IL)
Hydraulics of Flow in the Kaskaskia River, Illinois,
W80-03713 2E

KENTUCKY BLUEGRASS
Measuring Evapotranspiration of Turfgrass,
W80-03646 2D

KICKAPOO RIVER (WI)
Prediction of the Quality of Water in a Proposed Impoundment in Southwestern Wisconsin, USA,
W80-03801 5B

KINETICS
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter,
W80-03804 5C

KITIMAT INLET (BRITISH COLUMBIA)
Submarine Slide-Generated Water Waves in Kitimat Inlet, British Columbia,
W80-03627 2L

KLICAVA RESERVOIR
Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

KNAACK LAKE (WI)
Microbial Methanogenesis and Acetate Metabolism in a Meromictic Lake,
W80-03813 2H

LA PARGUERA
The Distribution of Algal Epiphytes on Macrophyte Hosts Offshore from La Parguera, Puerto Rico,
W80-03797 5C

LABOR SUPPLY
Employment in the Fishing Industry: Some Preliminary Findings on Fishermen's Mobility,
W80-03856 6F

LABORATORY EQUIPMENT
A Rainfall Simulator with Nonrepetitious Movement of Drop Outlets,
W80-03726 2B

The Design and Use of an Oscillating Trolley Wave-Simulator, for Installation in Unidirectional Flow Flumes,
W80-03737 2L

LABORATORY TESTS
Dissolved Oxygen and Biochemical Oxygen Demand,
W80-03612 5A

Observations of Stratified Flow Past Three-Dimensional Barriers,
W80-03624 8B

Infiltration of Soils as Affected by the Pressure and Water Content at the Time of Compaction,
W80-03722 2G

Air Bubbles in a Convectively Accelerated Water Flow,
W80-03740 8B

The Nutritional Ecology of Cyperus Esculentus, an Emergent Aquatic Plant, Grown on Different Sediments,
W80-03786 2I

The Microdistribution of Epiphytes on the Leaves of Natural and Artificial Macrophytes,
W80-03798 5C

LAGOON
Langebaan Lagoon: A Mixed Carbonate-Siliciclastic Tidal Environment in a Semi-Arid Climate,
W80-03865 2J

LAKE BISTINEAU (LA)
Effects of Mechanical Cutting on Submersed Vegetation in a Louisiana Lake,
W80-03832 4A

LAKE CHILWA
Zooplankton in a Quasi-Stable Phase in an Endorheic Lake (Lake Chilwa, Malawi),
W80-03807 5C

LAKE EKOLN
An Empirical Model for Physical Parameters of Recent Sedimentary Deposits of Lake Ekoln and Lake Vanern,
W80-03790 5A

LAKE ELEVATIONS
Water Resources Data for Florida, Water Year 1978--Volume 3A-1. Southwest Florida Surface Water.
W80-03754 7C

LAKE ERIE
Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

LAKE GREVELINGEN
Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands),
W80-03819 5C

LAKE MENDOTA (WI)
Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

Sterols in Natural Water and Sediment,
W80-03900 5C

LAKE MICHIGAN
Trace Element Loading of Southern Lake Michigan by Dry Deposition of Atmospheric Aerosol,
W80-03621 5B

LAKE ONTARIO
Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

LAKE ST. CLAIRE
Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

LAKE STAGES
Diatom Floristics and Succession in a Peat Bog Near Lily Lake, Summit County, Utah,
W80-03872 2H

LAKE SUPERIOR
Copper Mining from Under Lake Superior: The Legal Aspects,
W80-03759 6E

LAKE VANERN
An Empirical Model for Physical Parameters of Recent Sedimentary Deposits of Lake Ekoln and Lake Vanern,
W80-03790 5A

LAKE WINGRA (WI)
Sterols in Natural Water and Sediment,
W80-03900 5C

LAKES
Formulating Lake Models Which Preserve Spectral Statistics,
W80-03605 2H

Fish Mortality and Fishing During an Unprecedented Draught in Lake Pichhola, Udaipur,
W80-03698 2H

Surface-Water Features in Osceola County and Adjacent Areas, Florida,
W80-03761 7C

Verifying Lake Transport Models with Special Statistics,
W80-03836 2H

LAND CLEARING
Methods of Estimating Some Possible Interactions of Agricultural Development and Water Resources in Alaska,
W80-03711 2A

LAND SUBSIDENCE
Geophysical and Hydrologic Prediction of Fissuring and Land Subsidence, South-Central Arizona,
W80-03710 6A

LANDSLIDES
Submarine Slide-Generated Water Waves in Kitimat Inlet, British Columbia,
W80-03627 2L

LAWNS
Measuring Evapotranspiration of Turfgrass,
W80-03646 2D

LEACHING
Reclamation of Saline-Sodic Soils by Leaching,
W80-03723 2G

LEAD
Contributions of Urban Land Use to Stream Water Quality,
W80-03644 5B

The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

LEAD RADIOISOTOPES
Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

LEADERSHIP
Environmental Protection for Whom,
W80-03853 6B

LEGAL ASPECTS
The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

LEGISLATION
Environmental Quality and Economic Development,
W80-03857 6E

An Overview of Offshore Environmental Pollution Laws and Regulations in Canada, Greenland, and the North Sea,
W80-03896 5C

LIGHT
Phytoplankton Distribution and Light Attenuation in Port Hacking Estuary,
W80-03799 5C

Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

LIGHT INTENSITY
Light Stimulation of Phosphate Uptake in Natural Assemblages of Phytoplankton,
W80-03821 5C

LIMITING FACTORS
Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

LIQUID WASTES
Sources and Characteristics of Liquid Process Wastes from Arctic Offshore Hydrocarbon Exploration,
W80-03898 5C

LITTLE LAKE BARTON (FL)
Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

LOCH LEVEN
A Nine-Year Study of the Phytoplankton of the Eutrophic and Non-Stratifying Loch Leven (Kinross, Scotland),
W80-03816 5C

LODI (NJ)
The Influence of Urbanization of the Transport of Heavy Metals in New Jersey Streams,
W80-03774 5B

LONG-TERM PLANNING
Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

Impacts of the Western Drought on the Regional Electricity Situation.
W80-03843 6D

LOOSE BOULDERS
Hydraulics of a Large Channel Paved with Boulders,
W80-03741 2E

LOUISIANA
Establishment of Waterhyacinth Weevil Populations in Louisiana,
W80-03829 4A

LOW FLOW
Low-Flow Characteristics of Streams in the Pecatonica-Sugar River Basin, Wisconsin,
W80-03765 2E

LOW-FLOW FREQUENCY
Low-Flow Characteristics of Streams in the Pecatonica-Sugar River Basin, Wisconsin,
W80-03765 2E

MACROPHYTES
Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

MAINE
Phosphrus Export from Rural Maine Watersheds,
W80-03776 5B

MALAYSIA
The Ecology of Sandy Beaches in Penang, Malaysia, with Special Reference to Excirolana Orientalis (Dana),
W80-03633 2L

Employment in the Fishing Industry: Some Preliminary Findings on Fishermen's Mobility,
W80-03856 6F

MANGANESE
Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

Manganese Removal from Water by Flotation with Microgas Dispersions,
W80-03748 5F

MANGANESE REMOVAL
Manganese Removal from Water by Flotation with Microgas Dispersions,
W80-03748 5F

MANGROVE SWAMPS
Distribution of Macrofauna on a Malayan Mangrove Shore,
W80-03870 2I

Structure of Mangrove Forests in Florida, Puerto Rico, Mexico, and Costa Rica,
W80-03879 2I

MAPS
Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

MARINE ALGAE
The Effects of Bottle Volume, Thallus Weight, Oxygen Saturation Levels, and Water Movement on Apparent Photosynthetic Rates in Marine Algae,
W80-03659 5C

Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

The Distribution of Algal Epiphytes on Macrophyte Hosts Offshore from La Parguera, Puerto Rico,
W80-03797 5C

Two Phases of the Phytoplankton Community in the Baja California Upwelling,
W80-03805 5C

MARINE ANIMALS
Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

MARINE FISHERIES
Marine Resources Committee-Annual Review of Significant Legislative, Judicial and Administrative Activities During 1977.
W80-03889 6E

MARINE MAMMALS
Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

MARINE PLANTS
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

MARSH PLANTS
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

Photosynthetically Active Radiation in a Stand of Phragmites Communis Trin. II. Model of Light Extinction in the Stand,
W80-03869 2H

Phytosociological Studies of Uryu-Numa Mire Studies of Upland Bog Vegetation in Hokkaido (II), (In Japanese),
W80-03874 2I

Comparison of the Assemblages of Sap-Feeding Insects (Homoptera-Hemiptera) Inhabiting Two Structurally Different Salt Marsh Grasses in the Genus Spartina,
W80-03881 2I

Pattern and Diversity in Swamp and Dune Vegetation, North Stradbroke Island,
W80-03882 2I

MARSHES
Optimal Niche Space of the Redwinged Blackbird (Agelaius Phoeniceus), I. Nesting Success in Marsh and Upland Habitat,
W80-03875 2I

MATHEMATICAL MODELS
Formulating Lake Models Which Preserve Spectral Statistics,
W80-03605 2H

Dissolved Oxygen and Biochemical Oxygen Demand,
W80-03612 5A

Optimization of Unit Hydrograph Determination,
W80-03617 2E

An Analysis of the Irreversible Thermodynamics Model for Coupled Heat and Moisture Transport Phenomena in Unsaturated Porous Media,
W80-03639 1A

Level III: Receiving Water Quality Modeling for Urban Stormwater Management,
W80-03657 5D

The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

A Hysteresis Model Based on an Explicit Domain-Dependence Function,
W80-03720 2G

Air Bubbles in a Convectively Accelerated Water Flow,
W80-03740 8B

Flow in the Sea of Heavy Metals from a Smelter Industry,
W80-03788 5B

Very Simple Model of the Initial Stage of Oligotrophic-Eutrophic Succession. In Bodies of Water,
W80-03792 5A

Verifying Lake Transport Models with Special Statistics,
W80-03836 2H

A Parametric Model Calibrated with a Physically Based Model for Runoff Prediction from Ungaged Streams,
W80-03839 2E

MATHEMATICS
Environmental Management in General Equilibrium: A New Incentive Compatible Approach,
W80-03855 6B

MECHANICAL CONTROL
Effects of Mechanical Cutting on Submersed Vegetation in a Louisiana Lake,
W80-03832 4A

Mechanical Hydrilla Control in Orange Lake, Florida,
W80-03833 4A

British Columbia Aquatic Plant Management Program,
W80-03840 4A

MEMBRANES
Low Pressure Brackish Water Reverse Osmosis Membrane Development - Final Report,
W80-03749 3A

MENAI STRAIT (WALES)
The Sublittoral Ecology of the Menai Strait, I. Temporal and Spatial Variation in the Fauna and Flora Along a Transect,
W80-03634 2L

MERCURY
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

A Review of the Lethal and Sub-Lethal Effects of Mercury on Aquatic Life,
W80-03683 5A

In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

METABOLISM
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

Microbial Methanogenesis and Acetate Metabolism in a Meromictic Lake,
W80-03813 2H

METEOROLOGICAL DATA
Interim Progress Report Supplement a -- Data Analysis, SCPP Data Collection and Analysis for the Period 1 January 1979 Through 30 June 1979,
W80-03779 3B

METHANE BACTERIA
Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

Microbial Methanogenesis and Acetate Metabolism in a Meromictic Lake,
W80-03813 2H

METHODOLOGY
Quantitative Extraction of Chlorinated Organic Pesticides and Polychlorinated Biphenyls from Fish Organs and Tissues,
W80-03674 5A

A Method for Studying the Excretory Function of Fish Kidneys Under Chronic Experimental Conditions,
W80-03675 5A

Variation in the Reactions of Daphnia Magna Straus to the Effect of a Toxicant as Related to Its Delivery Regime,
W80-03676 5A

Preparation of Friable Aquiferous Specimens,
W80-03719 8E

METHYLMERCURY
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

A Review of the Lethal and Sub-Lethal Effects of Mercury on Aquatic Life,
W80-03683 5A

MICEROBIAL DEGRADATION
Effect of Benzoate on Microbial Decomposition of Fulvic Acids in Tjeukemeer (The Netherlands),
W80-03893 2K

MICHAELIS-MENTEN EQUATIONS
Light Stimulation of Phosphate Uptake in Natural Assemblages of Phytoplankton,
W80-03821 5C

MICHIGAN
Copper Mining from Under Lake Superior: The Legal Aspects,
W80-03759 6E

MICROBIAL DEGRADATION
The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

Semicontinuous Outdoor Cultivation of Scenedesmus Acutus in Waste Water,
W80-03705 5A

Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

Microbial Methanogenesis and Acetate Metabolism in a Meromictic Lake,
W80-03813 2H

MICROENVIRONMENT
The Microdistribution of Epiphytes on the Leaves of Natural and Artificial Macrophytes,
W80-03798 5C

MINE DRAINAGE
Effects of Mine Drainage on the River Hayle, Cornwall (A) Factors Affecting Concentrations of Copper, Zinc and Iron in Water, Sediments and Dominant Invertebrate Fauna,
W80-03891 5C

MINERAL INDUSTRY
Flow in the Sea of Heavy Metals from a Smelter Industry,
W80-03788 5B

MINING
Copper Mining from Under Lake Superior: The Legal Aspects,
W80-03759 6E

MIXING
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

MODEL STUDIES
Thermal Modeling of Highly Transient Flows in the Chattahoochee River Near Atlanta, Georgia,
W80-03615 2E

Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

A Reexamination of Bagnold's Granular-Fluid Model and Bed Load Transport Equation,
W80-03625 2J

Methods of Estimating Some Possible Interactions of Agricultural Development and Water Resources in Alaska,
W80-03711 2A

Damping of Gravity Waves over Porous Bed,
W80-03716 8B

Measured and Approximate Flux-Concentration Relations for Absorption of Water by Soil,
W80-03721 2G

Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

A Generalized Approach to Kinematic Flood Routing,
W80-03732 2E

On the Magnitude of Interfacial Shear of Subcritical Stratified Flows in Relation with Interfacial Stability,
W80-03738 2E

An Evaluation of Marginal Waters as a Natural Resource in Israel,
W80-03742 3C

The Geomorphologic Structure of Hydrologic Response,
W80-03743 2A

A Parametric Model Calibrated with a Physically Based Model for Runoff Prediction from Ungaged Streams,
W80-03839 2E

A Bioeconomic Model of the Gulf of Mexico Shrimp Fishery,
W80-03845 8I

Photosynthetically Active Radiation in a Stand of Phragmites Communis Trin. II. Model of Light Extinction in the Stand,
W80-03869 2H

MOLECULAR STRUCTURE
Effect of Benzoate on Microbial Decomposition of Fulvic Acids in Tjeukemeer (The Netherlands),
W80-03893 2K

MOLLUSKS
Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

MONITORING
Toward a Conceptual Framework for River-Quality Trend and Cause-Effect Analysis,
W80-03611 5B

A Periphyton Growth Substrate Useful for Nutrient Impact Studies in Large Rivers,
W80-03665 5A

Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

MONSOONS
Does Precipitation Pattern Foretell Gujarat Climate Becoming Arid,
W80-03638 2B

MONTANA
Structural Controls of Hot-Spring Systems in Southwestern Montana,
W80-03760 1A

MOSQUITOES
Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

Behavior of Abate in Microorganisms Isolated from Polluted Water,
W80-03892 5F

MOUNTAINS
Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

Interim Progress Report Supplement a -- Data Analysis, SCPP Data Collection and Analysis for the Period 1 January 1979 Through 30 June 1979,
W80-03779 3B

MOVEMENT
The Effects of Bottle Volume, Thallus Weight, Oxygen Saturation Levels, and Water Movement on Apparent Photosynthetic Rates in Marine Algae,
W80-03659 5C

MULTINATIONAL CORPORATIONS
Multinational Corporations, Nation-States and Ocean Resource Management: The Impact of the World's 200-Mile Economic Zone on Multinational and National Development,
W80-03859 6E

MUTAGENS
Mutagenicity of Fluorene Derivatives: A Proposed Mechanism,
W80-03745 5A

Mutagens in a River Heavily Polluted with Paper Recycling Wastes: Results of Field and Laboratory Mutagen Assays,
W80-03746 5A

NAPHTHALENES
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

NATURAL RECHARGE
Paul Spring: An Investigation of Recharge in the Roswell (NM) Artesian Basin,
W80-03642 2F

NATURAL RESOURCES
Adaptive Economics and Natural Resources Policy,
W80-03854 6B

NESTING
Optimal Niche Space of the Redwinged Blackbird (Agelaius Phoeniceus), I. Nesting Success in Marsh and Upland Habitat,
W80-03875 2I

NEW YORK
A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

NEW YORK BIGHT
Particle Reworking in Sediments from the New York Bight Apex: Evidence from 234Th/238U Disequilibrium,
W80-03629 2J

NEW ZEALAND
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

NICKEL
The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

NITRATES
Incidents of Elevated Nitrate in Southern Ontario,
W80-03623 5B

Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

NITROGEN
Early Growth of Picea Sitchensis (Bong.) Carr on Deep Oligotrophic Peat in Northern Ireland,
W80-03863 2I

NITROGEN FIXATION
Nitrogen Fixation by Thermophilic Blue-Green Algae (Cyanobacteria): Temperature Characteristics and Potential Use in Biophotolysis,
W80-03796 5F

NITROGEN FIXING BACTERIA
Nitrogen Fixation by Thermophilic Blue-Green Algae (Cyanobacteria): Temperature Characteristics and Potential Use in Biophotolysis,
W80-03796 5F

NOBLE GASES
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

NON-GAME BIRDS
Optimal Niche Space of the Redwinged Blackbird (Agelaius Phoeniceus), I. Nesting Success in Marsh and Upland Habitat,
W80-03875 2I

NONPOINT POLLUTION
Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

NORTH CAROLINA
Guidelines for Socioeconomic Impact Analyses of Environmental Regulations,
W80-03602 6C

A Technique for Estimating Heights Reached by the 100-Year Flood on Unregulated, Nontidal Streams in North Carolina,
W80-03764 2E

NORTH DAKOTA
Ground-Water Resources of Grant and Sioux Counties, North Dakota,
W80-03767 2F

NORTH SEA COAST
Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

NORTHWESTERN PENNSYLVANIA
Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

NOXFISH (TRADE NAME)
Rotenone Resistance of Golden Shiners from a Periodically Reclaimed Pond,
W80-03702 5A

NUCLEAR POWERPLANTS
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

NUTRIENT FLUX MODELS
Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter,
W80-03804 5C

NUTRIENT LOADING
Prediction of the Quality of Water in a Proposed Impoundment in Southwestern Wisconsin, USA,
W80-03801 5B

NUTRIENT REMOVAL
The Use of Multiple Inversion and Clean-Flo Lake Cleanser in Controlling Aquatic Plants,
W80-03828 4A

NUTRIENT REQUIREMENTS
Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter,
W80-03804 5C

Light Stimulation of Phosphate Uptake in Natural Assemblages of Phytoplankton,
W80-03821 5C

A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

NUTRIENTS
Impact of Nutrient Enrichment in a Waterchestnut Ecosystem at Takahama-Iri Bay of Lake Kasumigaura, Japan, II Role of Waterchestnut in Primary Productivity and Nutrient Uptake,
W80-03681 5B

The Nutritional Ecology of Cyperus Esculentus, an Emergent Aquatic Plant, Grown on Different Sediments,
W80-03786 2I

Factors Affecting Tissue Nutrient Concentrations in a Scirpus-Equisetum Wetland,
W80-03876 2I

OCEANOGRAPHY
Some Aspects of the Oceanography of the Gulf of Mexico Using Satellite and in Situ Data,
W80-03628 2L

OCEANS
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

Multinational Corporations, Nation-States and Ocean Resource Management: The Impact of the World's 200-Mile Economic Zone on Multinational and National Development,
W80-03859 6E

OIL POLLUTION
Method for Removing Suspended Oil Droplets from Water,
W80-03647 5D

Liability for Oil Pollution - United States Law,
W80-03667 6E

Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

An Overview of Offshore Environmental Pollution Laws and Regulations in Canada, Greenland, and the North Sea,
W80-03896 5C

Incorporation, Distribution and Fate of Saturated Petroleum Hydrocarbons in Sediments from a Controlled Marine Ecosystem,
W80-03899 5C

OIL SPILLS
Liability for Oil Pollution - United States Law,
W80-03667 6E

OKANAGON VALLEY
British Columbia Aquatic Plant Management Program,
W80-03840 4A

ON-SITE DATA COLLECTIONS
Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

ON-SITE INVESTIGATIONS
River-Quality Assessments.
W80-03606 5B

An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

Hydraulics of Flow in the Kaskaskia River, Illinois,
W80-03713 2E

ONTARIO
Incidents of Elevated Nitrate in Southern Ontario,
W80-03623 5B

Characteristics of Effluents from Gray and Black Water Septic Tanks,
W80-03791 5B

OPEN CHANNEL FLOW
Hydraulics of a Large Channel Paved with Boulders,
W80-03741 2E

OPEN CHANNELS
Hydraulics of a Large Channel Paved with Boulders,
W80-03741 2E

OPTIMIZATION
Optimization of Unit Hydrograph Determination,
W80-03617 2E

Pigovian Taxes, Polluter Subsidies, Regulation, and the Size of a Polluting Industry,
W80-03848 6E

The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

ORANGE LAKE (FL)
Mechanical Hydrilla Control in Orange Lake, Florida,
W80-03833 4A

OREGON
River-Quality Assessments.
W80-03606 5B

River-Quality Assessment: Concept, Framework, and Application in the Willamette River Basin, Oregon,
W80-03608 6B

Erosion Potential Assessment for the Willamette River Basin, Oregon,
W80-03613 7C

Algal Growth Potential--Lower Willamette River, Oregon,
W80-03614 5B

Surf Zone Dynamics During Upwelling on the Oregon Coast,
W80-03632 2L

ORGANIC COMPOUNDS
The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

Sterols in Natural Water and Sediment,
W80-03900 5C

ORGANIC LOADING
A Nine-Year Study of the Phytoplankton of the Eutrophic and Non-Stratifying Loch Leven (Kinross, Scotland),
W80-03816 5C

ORGANIC SOILS
Hydrologic Role of Shallow Organic Soils in Cold Climates,
W80-03649 2G

OSCEOLA COUNTY (FLA)
Surface-Water Features in Osceola County and Adjacent Areas, Florida,
W80-03761 7C

OSCILLATORY FLOW
Measurements of Combined Oscillatory and Steady Flow Over a Rough Bed,
W80-03620 8B

OUTER CONTINENTAL SHELF
Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

An Overview of Offshore Environmental Pollution Laws and Regulations in Canada, Greenland, and the North Sea,
W80-03896 5C

The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica,
W80-03897 5C

Sources and Characteristics of Liquid Process Wastes from Arctic Offshore Hydrocarbon Exploration,
W80-03898 5C

Incorporation, Distribution and Fate of Saturated Petroleum Hydrocarbons in Sediments from a Controlled Marine Ecosystem,
W80-03899 5C

OVERFLOW
Combined Sewer Overflow Treatment by Screening and Terminal Ponding -- Fort Wayne, Indiana,
W80-03656 5D

OXYGEN REQUIREMENTS
The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

OYSTERS
Dependence of the Time of Gamete Maturation and Spawning on Environmental Temperature in the Virginia Oyster Crassostrea Virginica,
W80-03679 5C

OZONE
Comparison of Ozone Contactors for Municipal Wastewater Effluent Disinfection -- Packed Column Versus Jet Scrubber,
W80-03653 5D

Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

PACIFIC NORTHWEST U.S.
Impacts of the Western Drought on the Regional Electricity Situation.
W80-03843 6D

PAPER RECYCLING
Mutagens in a River Heavily Polluted with Paper Recycling Wastes: Results of Field and Laboratory Mutagen Assays,
W80-03746 5A

PARATHION
An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

Pesticides and Aquatic Ecosystems,
W80-03699 5C

PATENTS
Flow Control Devices Particularly Useful for Drip Irrigation,
W80-03604 3F

Nitrification-Denitrification of Wastewater,
W80-03610 5D

Method for Removing Suspended Oil Droplets from Water,
W80-03647 5D

PATH OF POLLUTANTS
On the Value of Soil Columns for Assessing the Transport Pattern of Viruses Through Soils: A Critical Outlook,
W80-03622 5B

Incidents of Elevated Nitrate in Southern Ontario,
W80-03623 5B

Contributions of Urban Land Use to Stream Water Quality,
W80-03644 5B

Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

PEAK DISCHARGE
A Technique for Estimating Heights Reached by the 100-Year Flood on Unregulated, Nontidal Streams in North Carolina,
W80-03764 2E

PEAT
Early Growth of Picea Sitchensis (Bong.) Carr on Deep Oligotrophic Peat in Northern Ireland,
W80-03863 2I

PECATONICA-SUGAR RIVER BASIN (WIS)
Low-Flow Characteristics of Streams in the Pecatonica-Sugar River Basin, Wisconsin,
W80-03765 2E

PENANG (MALAYSIA)
The Ecology of Sandy Beaches in Penang, Malaysia, with Special Reference to Excirolana Orientalis (Dana),
W80-03633 2L

PENNSYLVANIA
Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

PEPTONE
The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

PERIPHYTON
A Periphyton Growth Substrate Useful for Nutrient Impact Studies in Large Rivers,
W80-03665 5A

PERMAFROST
Hydrologic Role of Shallow Organic Soils in Cold Climates,
W80-03649 2G

Snowmelt Infiltration Into Seasonally Frozen Soils,
W80-03650 2G

PERMEABILITY
Geohydrologic Model of the Floridan Aquifer in the Southwest Florida Water Management District,
W80-03751 2F

PESTICIDE KINETICS
Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

PESTICIDE RESIDUES
Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

PESTICIDE TOXICITY
The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

Pesticides and Aquatic Ecosystems,
W80-03699 5C

Dynamics and Behavioral Toxicology of Aqua-Kleen (Trade Name) (2,4-D Butoxyethanol Ester) as Revealed by the Modification of Rheotropism in Rainbow Trout,
W80-03703 5A

Behavior of Abate in Microorganisms Isolated from Polluted Water,
W80-03892 5F

PESTICIDES
Adsorption-Desorption of Diuron by Freshwater Sediments,
W80-03838 5B

PHAEOPHYTA
Experimental Ecology with Particular Reference to Proposed Commercial Harvesting of Durvillaea (Phaeophyta, Durvilleales) in New Zealand,
W80-03802 2I

PHENOLS
Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

PHOSPHAMIDON
Pesticides and Aquatic Ecosystems,
W80-03699 5C

PHOSPHATES
The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

Light Stimulation of Phosphate Uptake in Natural Assemblages of Phytoplankton,
W80-03821 5C

PHOSPHORUS
Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

Phosphrus Export from Rural Maine Watersheds,
W80-03776 5B

The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

Prediction of the Quality of Water in a Proposed Impoundment in Southwestern Wisconsin, USA,
W80-03801 5B

Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter,
W80-03804 5C

PHOTOSYNTHESIS
The Effects of Bottle Volume, Thallus Weight, Oxygen Saturation Levels, and Water Movement on Apparent Photosynthetic Rates in Marine Algae,
W80-03659 5C

Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

Impact of Nutrient Enrichment in a Waterchestnut Ecosystem at Takahama-Iri Bay of Lake Kasumigaura, Japan, II Role of Waterchestnut in Primary Productivity and Nutrient Uptake,
W80-03681 5B

Photosynthesis in the Aquatic Macrophyte Egeria Densa. III Gas Exchange Studies,
W80-03806 5C

Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

PHYSICAL PROPERTIES
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

PHYSICOCHEMICAL PROPERTIES
Composition and Abundance of Phytoplankton in Tributaries of the Lower Colorado River, Grand Canyon Region,
W80-03890 5C

PHYTOPLANKTON
The Effect of the Degree of Mineralization of Water on Phytoplankton,
W80-03664 5A

Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

Evaluation of Saprobicity of the Volgograd Reservoir in Terms of the Phytoplankton,
W80-03694 5C

The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

Phytoplankton Distribution and Light Attenuation in Port Hacking Estuary,
W80-03799 5C

Two Phases of the Phytoplankton Community in the Baja California Upwelling,
W80-03805 5C

Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

A Nine-Year Study of the Phytoplankton of the Eutrophic and Non-Stratifying Loch Leven (Kinross, Scotland),
W80-03816 5C

Light Stimulation of Phosphate Uptake in Natural Assemblages of Phytoplankton,
W80-03821 5C

Seasonal Succession of Phytoplankton in a Large Subarctic River,
W80-03824 5C

Composition and Abundance of Phytoplankton in Tributaries of the Lower Colorado River, Grand Canyon Region,
W80-03890 5C

Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

PIEDMONT
A Technique for Estimating Heights Reached by the 100-Year Flood on Unregulated, Nontidal Streams in North Carolina,
W80-03764 2E

PILOT PLANTS
Design of an Indirect Freezing Process Pilot Plant Based on Bulk Crystallization,
W80-03772 3A

PLANKTON
Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

PLANNING
Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

PLANT GROWTH
Phytomechanics--Plant Physiology and Applied Mechanics,
W80-03780 2I

Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

Experimental Ecology with Particular Reference to Proposed Commercial Harvesting of Durvillaea (Phaeophyta, Durvilleales) in New Zealand,
W80-03802 2I

Early Growth of Picea Sitchensis (Bong.) Carr on Deep Oligotrophic Peat in Northern Ireland,
W80-03863 2I

Comparative Biomass and Growth of Cypress in Florida Wetlands,
W80-03866 2I

PLANT GROWTH REGULATORS
Establishment of Waterhyacinth Weevil Populations in Louisiana,
W80-03829 4A

PLANT MORPHOLOGY
Structure of Mangrove Forests in Florida, Puerto Rico, Mexico, and Costa Rica,
W80-03879 2I

PLANT PHYSIOLOGY
Impact of Nutrient Enrichment in a Waterchestnut Ecosystem at Takahama-Iri Bay of Lake Kasumigaura, Japan, II Role of Waterchestnut in Primary Productivity and Nutrient Uptake,
W80-03681 5B

Phytomechanics--Plant Physiology and Applied Mechanics,
W80-03780 2I

Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

PLANT TISSUES
Taxonomic Characteristics of Aquatic Plants from the Alimentary Tract of Grass Carp,
W80-03831 4A

PLECOGLOSSUS
Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

POLICY
What Can We Get From Effluent Charges,
W80-03849 6B

Financial Statement Modeling: Analyzing the Pollution-Control Tax Incentive,
W80-03850 6B

POLITICAL ASPECTS
Estimating Willingness to Pay: Why and How.,
W80-03846 6B

Canadian-American Relations in the Arctic: The Effect of Environmental Influences Upon Territorial Claims,
W80-03852 6E

Environmental Protection for Whom,
W80-03853 6B

POLLUTANT IDENTIFICATION
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

POLLUTANTS
Environmental Management in General Equilibrium: A New Incentive Compatible Approach,
W80-03855 6B

POLLUTION ABATEMENT
Environmental Protection for Whom,
W80-03853 6B

POLLUTION CONTROLS
Formulating Lake Models Which Preserve Spectral Statistics,
W80-03605 2H

POLLUTION TAXES (CHARGES)
Pigovian Taxes, Polluter Subsidies, Regulation, and the Size of a Polluting Industry,
W80-03848 6E

What Can We Get From Effluent Charges,
W80-03849 6B

Financial Statement Modeling: Analyzing the Pollution-Control Tax Incentive,
W80-03850 6B

POLYCHAETES
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

PONDING
Combined Sewer Overflow Treatment by Screening and Terminal Ponding -- Fort Wayne, Indiana,
W80-03656 5D

POPULATION DYNAMICS
Zooplankton in a Quasi-Stable Phase in an Endorheic Lake (Lake Chilwa, Malawi),
W80-03807 5C

Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

Seasonal Succession of Phytoplankton in a Large Subarctic River,
W80-03824 5C

PORE PRESSURE
A Hysteresis Model Based on an Explicit Domain-Dependence Function,
W80-03720 2G

PORE WATER
A Hysteresis Model Based on an Explicit Domain-Dependence Function,
W80-03720 2G

POROSITY
Geohydrologic Model of the Floridan Aquifer in the Southwest Florida Water Management District,
W80-03751 2F

POROUS MEDIA
Preparation of Friable Aquiferous Specimens,
W80-03719 8E

PORPOISE
Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

PORT HACKING
The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

PORTUGAL
Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

POTABLE WATER
Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

POULTRY
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

PRECIPITATION (ATMOSPHERIC)
Interim Progress Report Supplement a -- Data Analysis, SCPP Data Collection and Analysis for the Period 1 January 1979 Through 30 June 1979,
W80-03779 3B

PREDATION
Effects of Dinoflagellate Bioluminescence on the Ingestion Rates of Herbivorous Zooplankton,
W80-03782 5C

Carnivorous Feeding Behavior of the Adult Calanoid Copepod Acartia Tonsa Dana,
W80-03783 5C

PRICES
Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues,
W80-03847 6B

PRIMARY PRODUCTIVITY
Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

PRINCIPAL COMPONENT ANALYSIS
Two Phases of the Phytoplankton Community in the Baja California Upwelling,
W80-03805 5C

PROBABILITY
Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

PRODUCTIVITY
Evaluation of Saprobicity of the Volgograd Reservoir in Terms of the Phytoplankton,
W80-03694 5C

Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

PROJECTS
Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

PROPERTY VALUES
Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues,
W80-03847 6B

PROTEINS
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

PSYCHOLOGICAL ASPECTS
Environmental Protection for Whom,
W80-03853 6B

PUBLIC HEALTH
Residential Water Reuse,
W80-03640 3D

Pesticides and Aquatic Ecosystems,
W80-03699 5C

PUBLICATIONS
Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

PULP AND PAPER INDUSTRY
Mutagens in a River Heavily Polluted with Paper Recycling Wastes: Results of Field and Laboratory Mutagen Assays,
W80-03746 5A

QUINALDINE
The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

RACINE (WIS)
Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

RADIOISOTOPES
Particle Reworking in Sediments from the New York Bight Apex: Evidence from 234Th/238U Disequilibrium,
W80-03629 2J

RAIN
Effects of Artificial Acid Rain on Microbial Activity and Biomass,
W80-03688 5C

RAINBOW TROUT
Dynamics and Behavioral Toxicology of Aqua-Kleen (Trade Name) (2,4-D Butoxyethanol Ester) as Revealed by the Modification of Rheotropism in Rainbow Trout,
W80-03703 5A

RAINFALL
Optimization of Unit Hydrograph Determination,
W80-03617 2E

Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

On the Assessment of Crop Droughts: A Case Study for Disa (Gujarat),
W80-03637 2B

Does Precipitation Pattern Foretell Gujarat Climate Becoming Arid,
W80-03638 2B

The Geomorphologic Structure of Hydrologic Response,
W80-03743 2A

RAINFALL SIMULATORS
A Rainfall Simulator with Nonrepetitious Movement of Drop Outlets,
W80-03726 2B

RANGIA
Rangia Cuneata in An Industrial Water System (Bivalvia: Mactridae),
W80-03669 5A

RECHARGE
Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains,
W80-03636 2F

Hydrology of Small Oceanic Islands--Utility of an Estimate of Recharge Inferred from the Chloride Concentration of the Freshwater Lenses,
W80-03729 2F

RECIRCULATED WATER
Residential Water Reuse,
W80-03640 3D

RECLAIMED WATER
Residential Water Reuse,
W80-03640 3D

RED TIDE
Two Phases of the Phytoplankton Community in the Baja California Upwelling,
W80-03805 5C

REGIONAL ANALYSIS
Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

Chesapeake Bay Future Conditions Report. Appendix 3. Economic and Social Profile.
W80-03844 6B

REGIONAL ECONOMICS
Chesapeake Bay Future Conditions Report. Appendix 3. Economic and Social Profile.
W80-03844 6B

REGULATION
Pigovian Taxes, Polluter Subsidies, Regulation, and the Size of a Polluting Industry,
W80-03848 6E

An Overview of Offshore Environmental Pollution Laws and Regulations in Canada, Greenland, and the North Sea,
W80-03896 5C

REGULATIONS
Guidelines for Socioeconomic Impact Analyses of Environmental Regulations,
W80-03602 6C

REMOTE SENSING
Some Aspects of the Oceanography of the Gulf of Mexico Using Satellite and in Situ Data,
W80-03628 2L

Interpretation of Unenhanced Landsat Imagery for Wetland and Land Use Delineation in the Texas Coastal Zone,
W80-03878 7C

RESEARCH EQUIPMENT
A Periphyton Growth Substrate Useful for Nutrient Impact Studies in Large Rivers,
W80-03665 5A

An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

RESERVOIR OPERATION
The Anticipated Decision Influence Period in Real Time Reservoir Operation,
W80-03645 6A

RESERVOIR OPERATION MODEL
The Anticipated Decision Influence Period in Real Time Reservoir Operation,
W80-03645 6A

RESERVOIR RELEASE DECISIONS
The Anticipated Decision Influence Period in Real Time Reservoir Operation,
W80-03645 6A

RESERVOIR STORAGE
The Anticipated Decision Influence Period in Real Time Reservoir Operation,
W80-03645 6A

RESERVOIRS
Evaluation of Saprobicity of the Volgograd Reservoir in Terms of the Phytoplankton,
W80-03694 5C

RESISTANCE
Rotenone Resistance of Golden Shiners from a Periodically Reclaimed Pond,
W80-03702 5A

RESOURCE ALLOCATION
American Bar Association Resolution Re Natural Resources of the Sea Adopted by the House of Delegates, August 6, 1973 and Report of the Section of Natural Resources Law Recommending Adoption of the Resolution.
W80-03695 6E

RESOURCE MANAGEMENT
Environmental Management in General Equilibrium: A New Incentive Compatible Approach,
W80-03855 6B

RESOURCES DEVELOPMENT
Fishermen's Remuneration Systems and Implications for Fisheries Development,
W80-03858 6C

Multinational Corporations, Nation-States and Ocean Resource Management: The Impact of the World's 200-Mile Economic Zone on Multinational and National Development,
W80-03859 6E

REVERSE OSMOSIS
Low Pressure Brackish Water Reverse Osmosis Membrane Development - Final Report,
W80-03749 3A

RHEOTROPISM
Dynamics and Behavioral Toxicology of Aqua-Kleen (Trade Name) (2,4-D Butoxyethanol Ester) as Revealed by the Modification of Rheotropism in Rainbow Trout,
W80-03703 5A

RHINE ESTUARY
Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

RILL DEVELOPMENT SIMULATION
Role of Rill Development in Salt Loading from Hillslopes,
W80-03643 2J

RIPARIAN PLANTS
Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

RISKS
The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

Fishermen's Remuneration Systems and Implications for Fisheries Development,
W80-03858 6C

RIVER BASINS
River-Quality Assessments.
W80-03606 5B

River-Quality Assessment--A Rational Scientific Basis for Pollution Control and Water-Quality Management,
W80-03607 5G

River-Quality Assessment: Concept, Framework, and Application in the Willamette River Basin, Oregon,
W80-03608 6B

An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

Erosion Potential Assessment for the Willamette River Basin, Oregon,
W80-03613 7C

Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

RIVER FLOW
Hydraulics of Flow in the Kaskaskia River, Illinois,
W80-03713 2E

RIVER HAYLE (UK)
Effects of Mine Drainage on the River Hayle, Cornwall (A) Factors Affecting Concentrations of Copper, Zinc and Iron in Water, Sediments and Dominant Invertebrate Fauna,
W80-03891 5C

RIVERS
Toward a Conceptual Framework for River-Quality Trend and Cause-Effect Analysis,
W80-03611 5B

Algal Growth Potential--Lower Willamette River, Oregon,
W80-03614 5B

Thermal Modeling of Highly Transient Flows in the Chattahoochee River Near Atlanta, Georgia,
W80-03615 2E

Turbulence Measurements in the Boundary Layer Over a Sand Wave Field,
W80-03626 2E

Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

RODENTS
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

ROOT SYSTEMS
The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

ROOTED AQUATIC PLANTS
The Absorption of DDT by Vascular Aquatic Plants,
W80-03663 5B

Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

ROSWELL (N MEX)
Low Pressure Brackish Water Reverse Osmosis Membrane Development - Final Report,
W80-03749 3A

ROTENONE
Rotenone Resistance of Golden Shiners from a Periodically Reclaimed Pond,
W80-03702 5A

RUNOFF
Optimization of Unit Hydrograph Determination,
W80-03617 2E

Role of Rill Development in Salt Loading from Hillslopes,
W80-03643 2J

The Geomorphologic Structure of Hydrologic Response,
W80-03743 2A

A Parametric Model Calibrated with a Physically Based Model for Runoff Prediction from Ungaged Streams,
W80-03839 2E

RUNOFF COLD REGIONS
Hydrologic Role of Shallow Organic Soils in Cold Climates,
W80-03649 2G

SADDLE RIVER BASIN (NJ)
The Influence of Urbanization of the Transport of Heavy Metals in New Jersey Streams,
W80-03774 5B

SALINE SOILS
Reclamation of Saline-Sodic Soils by Leaching,
W80-03723 2G

SALINITY
The Effect of the Degree of Mineralization of Water on Phytoplankton,
W80-03664 5A

SALMONELLA
Mutagenicity of Fluorene Derivatives: A Proposed Mechanism,
W80-03745 5A

SALT MARSHES
An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

The Ecology of a Saltmarsh in Sri Lanka,
W80-03871 2I

Comparison of the Assemblages of Sap-Feeding Insects (Homoptera-Hemiptera) Inhabiting Two Structurally Different Salt Marsh Grasses in the Genus Spartina,
W80-03881 2I

SALT YIELD
Role of Rill Development in Salt Loading from Hillslopes,
W80-03643 2J

SALVINIA
A New Approach for Salvinia Control,
W80-03827 4A

SAMPLING
Preparation of Friable Aquiferous Specimens,
W80-03719 8E

SAN CLEMENTE ISLAND (CALIF)
Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

SAN JUAN BASIN
Ground Water in the San Juan Basin, New Mexico and Colorado,
W80-03763 2F

SAND WAVES
Turbulence Measurements in the Boundary Layer Over a Sand Wave Field,
W80-03626 2E

SCALLOPS
Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

SCENEDESMUS
Semicontinuous Outdoor Cultivation of Scenedesmus Acutus in Waste Water,
W80-03705 5A

SCHELDT ESTUARY
Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

SCOTLAND COAST
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

SCREENS
Combined Sewer Overflow Treatment by Screening and Terminal Ponding -- Fort Wayne, Indiana,
W80-03656 5D

SEAGRASS
The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

SEAGRASSES
Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

SEASONAL
Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

SEDIMENT DISTRIBUTION
Langebaan Lagoon: A Mixed Carbonate-Siliciclastic Tidal Environment in a Semi-Arid Climate,
W80-03865 2J

SEDIMENT TRANSPORT
A Reexamination of Bagnold's Granular-Fluid Model and Bed Load Transport Equation,
W80-03625 2J

SEDIMENT YIELD
Role of Rill Development in Salt Loading from Hillslopes,
W80-03643 2J

SEDIMENTATION
An Empirical Model for Physical Parameters of Recent Sedimentary Deposits of Lake Ekoln and Lake Vanern,
W80-03790 5A

Holocene Sedimentation at Cape Sable, South Florida,
W80-03864 2J

SEDIMENTATION RATES
Recent Geochemical History of Flood Deposits in the Northern Chesapeake Bay,
W80-03735 2J

SEDIMENTS
Particle Reworking in Sediments from the New York Bight Apex: Evidence from 234Th/238U Disequilibrium,
W80-03629 2J

Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations,
W80-03631 2J

Sediments Suspended in Stream Flow,
W80-03718 2J

The Nutritional Ecology of Cyperus Esculentus, an Emergent Aquatic Plant, Grown on Different Sediments,
W80-03786 2I

An Empirical Model for Physical Parameters of Recent Sedimentary Deposits of Lake Ekoln and Lake Vanern,
W80-03790 5A

Effects of Mine Drainage on the River Hayle, Cornwall (A) Factors Affecting Concentrations of Copper, Zinc and Iron in Water, Sediments and Dominant Invertebrate Fauna,
W80-03891 5C

Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

Incorporation, Distribution and Fate of Saturated Petroleum Hydrocarbons in Sediments from a Controlled Marine Ecosystem,
W80-03899 5C

Sterols in Natural Water and Sediment,
W80-03900 5C

SELENIUM
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

SEPARATED SEWERS
Characteristics of Effluents from Gray and Black Water Septic Tanks,
W80-03791 5B

SEPARATION TECHNIQUES
Method for Removing Suspended Oil Droplets from Water,
W80-03647 5D

SEPTIC TANKS
Characteristics of Effluents from Gray and Black Water Septic Tanks,
W80-03791 5B

SESSILE ALGAE
Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

SEWAGE DISPOSAL
A Review of New Colorado Water and Air Pollution Legislation,
W80-03668 6E

SEWAGE EFFLUENTS
Investigations on the Effects of Domestic Sewage on the Benthic Ecosystem of Marine Intertidal Flats (In German),
W80-03684 5C

SEWAGE SLUDGE
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

SEWERAGE
The Distribution and Ecology of the Naididae (Oligochaeta) Which Inhabit the Filter-Beds of Sewage-Works in Britain,
W80-03666 5C

SHANNON-WIENER INDEX
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

SHEAR
Flow Visualization in Complex Turbulent Flows,
W80-03715 8B

SHELLFISH FARMING
Legal and Institutional Factors Affecting Mariculture in Texas,
W80-03873 6E

SHINERS
Rotenone Resistance of Golden Shiners from a Periodically Reclaimed Pond,
W80-03702 5A

SHORE PROTECTION
Water Resource Policies and Authorities: Federal Participation in Shore, Hurricane, Tidal and Lake Flood Protection (Final Rule).
W80-03877 6E

SHORE PROTECTION

Marine Resources Committee-Annual Review of Significant Legislative, Judicial and Administrative Activities During 1977.
W80-03889 6E

SHRIMP
The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

A Bioeconomic Model of the Gulf of Mexico Shrimp Fishery,
W80-03845 8I

SIMULATED RAINFALL
A Rainfall Simulator with Nonrepetitious Movement of Drop Outlets,
W80-03726 2B

SIMULATION
An Interactive River Basin Water Management Model: Synthesis and Application,
W80-03708 6A

SIOUX COUNTY (N DAK)
Ground-Water Resources of Grant and Sioux Counties, North Dakota,
W80-03767 2F

SIZE
Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure,
W80-03815 5A

Pigovian Taxes, Polluter Subsidies, Regulation, and the Size of a Polluting Industry,
W80-03848 6E

SKELLEFTE BAY
Flow in the Sea of Heavy Metals from a Smelter Industry,
W80-03788 5B

SLUDGE DISPOSAL
The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

SNAKE RIVER
Effects of Dams and Impoundments on Migrations of Juvenile Chinook Salmon and Steelhead from the Snake River, 1966 to 1975,
W80-03701 5A

SNOWMELT RUNOFF
Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

SOCIAL ADJUSTMENT
Systems Ecology, People Ecology, and the Anthropology of Fishing Communities,
W80-03860 6B

SOCIAL ASPECTS
Chesapeake Bay Future Conditions Report. Appendix 3. Economic and Social Profile.
W80-03844 6B

Estimating Willingness to Pay: Why and How.,
W80-03846 6B

Employment in the Fishing Industry: Some Preliminary Findings on Fishermen's Mobility,
W80-03856 6F

SOCIAL IMPACT
Systems Ecology, People Ecology, and the Anthropology of Fishing Communities,
W80-03860 6B

SOCIAL MOBILITY
Employment in the Fishing Industry: Some Preliminary Findings on Fishermen's Mobility,
W80-03856 6F

SOIL BACTERIA
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

SOIL COMPACTION
Infiltration of Soils as Affected by the Pressure and Water Content at the Time of Compaction,
W80-03722 2G

SOIL EROSION
Soil and Water Losses from Corn-Soybean Rotations,
W80-03725 2J

SOIL MOISTURE
Snowmelt Infiltration Into Seasonally Frozen Soils,
W80-03650 2G

Measured and Approximate Flux-Concentration Relations for Absorption of Water by Soil,
W80-03721 2G

SOIL TEMPERATURE
Harper Seeks Climate Control with Sprinkled Vegetables,
W80-03658 2I

SOIL WATER
Snowmelt Infiltration Into Seasonally Frozen Soils,
W80-03650 2G

Measured and Approximate Flux-Concentration Relations for Absorption of Water by Soil,
W80-03721 2G

SOIL WATER MOVEMENT
Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains,
W80-03636 2F

Determination of Selected Hydraulic Properties of Subarctic Soils,
W80-03648 2G

Effect of Tillage on Soil-Water Movement During Corn Growth,
W80-03724 2G

Influence of a Compact Zone on Solute Transport During Infiltration of Water,
W80-03727 2G

Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

SOILS
On the Value of Soil Columns for Assessing the Transport Pattern of Viruses Through Soils: A Critical Outlook,
W80-03622 5B

SOLAR DISTILLATION
Technical and Economic Assessment of Solar Distillation for Large Scale Production in Fresh Water.
W80-03842 3A

SOLUTES
Influence of a Compact Zone on Solute Transport During Infiltration of Water,
W80-03727 2G

SOLVENTS
Quantitative Extraction of Chlorinated Organic Pesticides and Polychlorinated Biphenyls from Fish Organs and Tissues,
W80-03674 5A

SOUTHERN CALIFORNIA
Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

SOUTHWEST FLORIDA
Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

SOUTHWEST MONTANA
Structural Controls of Hot-Spring Systems in Southwestern Montana,
W80-03760 1A

SOYBEANS
Soil and Water Losses from Corn-Soybean Rotations,
W80-03725 2J

SPATIAL DISTRIBUTION
Spatial Aspects of the Pressure for Shoreline Development: The Example of Puget Sound,
W80-03884 6E

SPECIATION
Species Composition and Seasonal Occurence of Centric Diatoms in a Polluted Marine Environment,
W80-03820 5C

SPECIES DIVERSITY
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

Zooplankters as Bioindicators of Water Quality,
W80-03678 5C

Investigations on the Effects of Domestic Sewage on the Benthic Ecosystem of Marine Intertidal Flats (In German),
W80-03684 5C

The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

SPECIES DIVERSITY INDICES
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

Zooplankters as Bioindicators of Water Quality,
W80-03678 5C

SPEICATION
Very Simple Model of the Initial Stage of Oligotrophic-Eutrophic Succession. In Bodies of Water,
W80-03792 5A

SPILLWAYS
Hydraulics of Rectangular Vertical Drop Structures,
W80-03739 2E

SPOKANE (WASH)
Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78,
W80-03769 2F

SPRING FLOW
Paul Spring: An Investigation of Recharge in the Roswell (NM) Artesian Basin,
W80-03642 2F

SPRINKLER IRRIGATION
Harper Seeks Climate Control with Sprinkled Vegetables,
W80-03658 2I

ST. LAWRENCE RIVER
Hydrochemistry of Dissolved Inorganic Carbon in the St. Lawrence Estuary (Canada),
W80-03736 2L

STANDING CROPS
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

STATIONS
Index to Sources of Hydrologic Data,
W80-03744 7C

STATISTICAL ANALYSIS
Statistical Analysis of Hydrologic Critical Droughts,
W80-03618 2E

STEADY FLOW
Measurements of Combined Oscillatory and Steady Flow Over a Rough Bed,
W80-03620 8B

STILLING WELL
Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

STOCHASTIC PROCESSES
Statistical Analysis of Hydrologic Critical Droughts,
W80-03618 2E

STORM DRAINS
Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

Combined Sewer Overflow Treatment by Screening and Terminal Ponding -- Fort Wayne, Indiana,
W80-03656 5D

STORM RUNOFF
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

Erosional Aspects of Managing Urban Streams,
W80-03773 2J

STORMS
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

STRATIFIED FLOW
On the Magnitude of Interfacial Shear of Subcritical Stratified Flows in Relation with Interfacial Stability,
W80-03738 2E

STRATIGRAPHY
Age, Origin, and Palaeo-Ecological Evidence of Blanket Bogs in Nord-Trondelag, Norway,
W80-03868 2J

STREAM STABILIZATION
Erosional Aspects of Managing Urban Streams,
W80-03773 2J

STREAMFLOW
Sediments Suspended in Stream Flow,
W80-03718 2J

Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

Low-Flow Characteristics of Streams in the Pecatonica-Sugar River Basin, Wisconsin,
W80-03765 2E

STREAMS
Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

A Technique for Estimating Heights Reached by the 100-Year Flood on Unregulated, Nontidal Streams in North Carolina,
W80-03764 2E

Stream Types in Idaho: An Approach to Classification of Streams in Natural Areas,
W80-03835 6B

STRONTIUM RADIOISOTOPES
Eye Damage to the Grass Carp (Ctenopharyngodon Idella) from Chronic Uptake of Strontium 90,
W80-03697 5C

STRUCTURAL GEOLOGY
Structural Controls of Hot-Spring Systems in Southwestern Montana,
W80-03760 1A

STRUCTURES
Hydraulics of Rectangular Vertical Drop Structures,
W80-03739 2E

SUBARCTIC
Hydrologic Role of Shallow Organic Soils in Cold Climates,
W80-03649 2G

Seasonal Succession of Phytoplankton in a Large Subarctic River,
W80-03824 5C

SUBARTIC
Determination of Selected Hydraulic Properties of Subarctic Soils,
W80-03648 2G

SUBCRITICAL FLOW
On the Magnitude of Interfacial Shear of Subcritical Stratified Flows in Relation with Interfacial Stability,
W80-03738 2E

SUBMARINE SLIDES
Submarine Slide-Generated Water Waves in Kitimat Inlet, British Columbia,
W80-03627 2L

SUBSTRATES
A Periphyton Growth Substrate Useful for Nutrient Impact Studies in Large Rivers,
W80-03665 5A

SUBSURFACE WATERS
Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

SUCCESSION
Very Simple Model of the Initial Stage of Oligotrophic-Eutrophic Succession. In Bodies of Water,
W80-03792 5A

Seasonal Succession of Phytoplankton in a Large Subarctic River,
W80-03824 5C

SUNFISHES
Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

SURFACE RUNOFF
A Parametric Model Calibrated with a Physically Based Model for Runoff Prediction from Ungaged Streams,
W80-03839 2E

SURFACE WATERS
Water Resources Data for Indiana, Water Year 1978.
W80-03752 7C

Water Resources Data for Alaska, Water Year 1978.
W80-03753 7C

Water Resources Data for Florida, Water Year 1978--Volume 3A-1. Southwest Florida Surface Water.
W80-03754 7C

Water Resources Data for Florida, Water Year 1978--Volume 3A-2. Southwest Florida Surface Water Quality.
W80-03755 7C

Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

Surface-Water Features in Osceola County and Adjacent Areas, Florida,
W80-03761 7C

SURFACTANTS
Manganese Removal from Water by Flotation with Microgas Dispersions,
W80-03748 5F

The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

A New Approach for Salvinia Control,
W80-03827 4A

SUSPENDED SOLIDS
Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations,
W80-03631 2J

Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

Sediments Suspended in Stream Flow,
W80-03718 2J

SWAMPS
Comparative Biomass and Growth of Cypress in Florida Wetlands,
W80-03866 2I

SYRACUSE (NY)
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

SYSTEMATICS
Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure,
W80-03815 5A

TAMPA BAY (FL)
The Effects of Oyster Shell Dredging on an Estuarine Benthic Community,
W80-03734 2L

TARPON SPRINGS (FL)
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

TEMPERATURE
The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

TEMPERATURE

Nitrogen Fixation by Thermophilic Blue-Green Algae (Cyanobacteria): Temperature Characteristics and Potential Use in Biophotolysis,
W80-03796 5F

Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter,
W80-03804 5C

TEMPERATURE CONTROL

Harper Seeks Climate Control with Sprinkled Vegetables,
W80-03658 2I

TENNESSEE

Public Water Supplies: The Effect of Federal and Tennessee Water Resource Law,
W80-03601 6E

TERATOGENS

Studies on the Effects of Acidic Medium on the Fry of Cyprinus Carpio,
W80-03706 5A

TERRAIN ANALYSIS

Interpretation of Unenhanced Landsat Imagery for Wetland and Land Use Delineation in the Texas Coastal Zone,
W80-03878 7C

TEXAS

Legal and Institutional Factors Affecting Mariculture in Texas,
W80-03873 6E

Interpretation of Unenhanced Landsat Imagery for Wetland and Land Use Delineation in the Texas Coastal Zone,
W80-03878 7C

THAMES RIVER (CT)

Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations,
W80-03631 2J

THEORETICAL ANALYSIS

Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues,
W80-03847 6B

Fishermen's Remuneration Systems and Implications for Fisheries Development,
W80-03858 6C

THERMAL SPRINGS

Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

THERMAL WATER

Thermal Modeling of Highly Transient Flows in the Chattahoochee River Near Atlanta, Georgia,
W80-03615 2E

THERMODYNAMIC BEHAVIOR

An Analysis of the Irreversible Thermodynamics Model for Coupled Heat and Moisture Transport Phenomena in Unsaturated Porous Media,
W80-03639 1A

TIDAL EFFECTS

Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

TIDAL WATERS

The Sublittoral Ecology of the Menai Strait, I. Temporal and Spatial Variation in the Fauna and Flora Along a Transect,
W80-03634 2L

Tidal Hydraulics in Estuarine Channels,
W80-03714 2L

TIDES

Tidal Hydraulics in Estuarine Channels,
W80-03714 2L

TISSUE ANALYSIS

The Absorption of DDT by Vascular Aquatic Plants,
W80-03663 5B

Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

Quantitative Extraction of Chlorinated Organic Pesticides and Polychlorinated Biphenyls from Fish Organs and Tissues,
W80-03674 5A

Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

Eye Damage to the Grass Carp (Ctenopharyngodon Idella) from Chronic Uptake of Strontium 90,
W80-03697 5C

Pesticides and Aquatic Ecosystems,
W80-03699 5C

TJEUKEMEER (THE NETHERLANDS)

Effect of Benzoate on Microbial Decomposition of Fulvic Acids in Tjeukemeer (The Netherlands),
W80-03893 2K

TMP

Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

TOLUENE

Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

TORCH LAKE (MI)

Sterols in Natural Water and Sediment,
W80-03900 5C

TOXICITY

Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

Variation in the Reactions of Daphnia Magna Straus to the Effect of a Toxicant as Related to Its Delivery Regime,
W80-03676 5A

Dependence of the Time of Gamete Maturation and Spawning on Environmental Temperature in the Virginia Oyster Crassostrea Virginica,
W80-03679 5C

The Relationship Between Vertebral Number and Water Temperature in Cod,
W80-03680 5A

A Review of the Lethal and Sub-Lethal Effects of Mercury on Aquatic Life,
W80-03683 5A

Investigations on the Effects of Domestic Sewage on the Benthic Ecosystem of Marine Intertidal Flats (In German),
W80-03684 5C

Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

Studies on the Effects of Acidic Medium on the Fry of Cyprinus Carpio,
W80-03706 5A

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

TRACE ELEMENTS

Trace Element Loading of Southern Lake Michigan by Dry Deposition of Atmospheric Aerosol,
W80-03621 5B

TRAFFORD LAKE (FL)

Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

TRAPA

Impact of Nutrient Enrichment in a Waterchestnut Ecosystem at Takahama-Iri Bay of Lake Kasumigaura, Japan, II Role of Waterchestnut in Primary Productivity and Nutrient Uptake,
W80-03681 5B

TREES

Early Growth of Picea Sitchensis (Bong.) Carr on Deep Oligotrophic Peat in Northern Ireland,
W80-03863 2I

TRITIUM

Paul Spring: An Investigation of Recharge in the Roswell (NM) Artesian Basin,
W80-03642 2F

TUCSON BASIN

The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

TURBULENCE

Turbulence Measurements in the Boundary Layer Over a Sand Wave Field,
W80-03626 2E

Flow Visualization in Complex Turbulent Flows,
W80-03715 8B

TURBULENCE ENERGY CLOSURE MODELS

On the Calculation of the Width Averaged Flow Due to Long Waves in an Open Channel,
W80-03619 2E

TURBULENT BOUNDARY LAYERS

On the Calculation of the Width Averaged Flow Due to Long Waves in an Open Channel,
W80-03619 2E

TURBULENT FLOW
On the Calculation of the Width Averaged Flow Due to Long Waves in an Open Channel,
W80-03619 2E

TURFGRASSES
Measuring Evapotranspiration of Turfgrass,
W80-03646 2D

U-SHAPED CONSTRICTION
Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

UNIT HYDROGRAPHS
Optimization of Unit Hydrograph Determination,
W80-03617 2E

UNITED KINGDOM
The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

UNITED STATES
Canadian-American Relations in the Arctic: The Effect of Environmental Influences Upon Territorial Claims,
W80-03852 6E

UPWELLING
Surf Zone Dynamics During Upwelling on the Oregon Coast,
W80-03632 2L

URBAN HYDROLOGY
Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

URBAN RUNOFF
Contributions of Urban Land Use to Stream Water Quality,
W80-03644 5B

Level III: Receiving Water Quality Modeling for Urban Stormwater Management,
W80-03657 5D

Erosional Aspects of Managing Urban Streams,
W80-03773 2J

URBANIZATION
Erosional Aspects of Managing Urban Streams,
W80-03773 2J

URINALYSIS
A Method for Studying the Excretory Function of Fish Kidneys Under Chronic Experimental Conditions,
W80-03675 5A

UTAH
Diatom Floristics and Succession in a Peat Bog Near Lily Lake, Summit County, Utah,
W80-03872 2H

VEGETABLE CROPS
Harper Seeks Climate Control with Sprinkled Vegetables,
W80-03658 2I

VELOCITY
Measurements of Combined Oscillatory and Steady Flow Over a Rough Bed,
W80-03620 8B

VERTEBRAE
The Relationship Between Vertebral Number and Water Temperature in Cod,
W80-03680 5A

VERTICAL DISTRIBUTION
The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

VERTICAL DROP SPILLWAYS
Hydraulics of Rectangular Vertical Drop Structures,
W80-03739 2E

VIRUS INACTIVATION
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

VIRUSES
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

On the Value of Soil Columns for Assessing the Transport Pattern of Viruses Through Soils: A Critical Outlook,
W80-03622 5B

VISCOUS FLOW
Damping of Gravity Waves over Porous Bed,
W80-03716 8B

VOLUME
The Effects of Bottle Volume, Thallus Weight, Oxygen Saturation Levels, and Water Movement on Apparent Photosynthetic Rates in Marine Algae,
W80-03659 5C

WASHINGTON
Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78,
W80-03769 2F

Spatial Aspects of the Pressure for Shoreline Development: The Example of Puget Sound,
W80-03884 6E

WASTE DILUTION
Staged Multiport Diffusers,
W80-03717 5B

WASTE DISPOSAL
On the Value of Soil Columns for Assessing the Transport Pattern of Viruses Through Soils: A Critical Outlook,
W80-03622 5B

WASTE WATER
The Potential for Municipal Wastewater Reuse by Industry in Massachusetts,
W80-03747 3C

WASTE WATER (POLLUTION)
Flow in the Sea of Heavy Metals from a Smelter Industry,
W80-03788 5B

WASTE WATER TREATMENT
Nitrification-Denitrification of Wastewater,
W80-03610 5D

Method for Removing Suspended Oil Droplets from Water,
W80-03647 5D

Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

Comparison of Ozone Contactors for Municipal Wastewater Effluent Disinfection -- Packed Column Versus Jet Scrubber,
W80-03653 5D

Level III: Receiving Water Quality Modeling for Urban Stormwater Management,
W80-03657 5D

Semicontinuous Outdoor Cultivation of Scenedesmus Acutus in Waste Water,
W80-03705 5A

The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

WASTEWATER TREATMENT
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

WATER ALLOCATION (POLICY)
Reborn Federalism in Western Water Law: The New Melones Dam Decision,
W80-03795 6E

Breathing New Life into Section 8 of the 1902 Reclamation Act: California V. United States,
W80-03814 6E

Sale and Lease of Indian Water Rights,
W80-03880 6E

WATER CHEMISTRY
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

Hydrochemistry of Dissolved Inorganic Carbon in the St. Lawrence Estuary (Canada),
W80-03736 2L

Sterols in Natural Water and Sediment,
W80-03900 5C

WATER CIRCULATION
The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

WATER CONSERVATION
Residential Water Reuse,
W80-03640 3D

The Potential for Municipal Wastewater Reuse by Industry in Massachusetts,
W80-03747 3C

Impacts of the Western Drought on the Regional Electricity Situation.
W80-03843 6D

WATER DISTRIBUTION (APPLIED)
Owner Eligibility Restrictions - Acreage and Residency,
W80-03883 6E

WATER DISTRICTS
'One Person, One Vote' and California's Water Districts,
W80-03886 6E

WATER HYACINTH
Establishment of Waterhyacinth Weevil Populations in Louisiana,
W80-03829 4A

WATER LAW
Public Water Supplies: The Effect of Federal and Tennessee Water Resource Law,
W80-03601 6E

Residential Water Reuse,
W80-03640 3D

WATER LEVEL FLUCTUATIONS
Development of Ground Water in the Houston District, Texas, 1970-74,
W80-03768 4B

Zooplankton in a Quasi-Stable Phase in an Endorheic Lake (Lake Chilwa, Malawi),
W80-03807 5C

WATER MANAGEMENT (APPLIED)
River-Quality Assessment--A Rational Scientific Basis for Pollution Control and Water-Quality Management,
W80-03607 5G

Spatial Aspects of the Pressure for Shoreline Development: The Example of Puget Sound,
W80-03884 6E

WATER POLICY
Impacts of the Western Drought on the Regional Electricity Situation.
W80-03843 6D

WATER POLLUTION
Mutagens in a River Heavily Polluted with Paper Recycling Wastes: Results of Field and Laboratory Mutagen Assays,
W80-03746 5A

Behavior of Abate in Microorganisms Isolated from Polluted Water,
W80-03892 5F

An Overview of Offshore Environmental Pollution Laws and Regulations in Canada, Greenland, and the North Sea,
W80-03896 5C

Sources and Characteristics of Liquid Process Wastes from Arctic Offshore Hydrocarbon Exploration,
W80-03898 5C

WATER POLLUTION CONTROL
River-Quality Assessment--A Rational Scientific Basis for Pollution Control and Water-Quality Management,
W80-03607 5G

Liability for Oil Pollution - United States Law,
W80-03667 6E

Will Judicial Error Allow Industrial Point Sources to Avoid BPT and Perhaps BAT Later. A Story of Good Intentions, Bad Dictum, and Ugly Consequences,
W80-03885 6E

The Convention for the Prevention of Marine Pollution from Land-Based Sources: An Effective Method for Arbitrating International Effluent Pollution Disputes,
W80-03887 6E

Marine Resources Committee-Annual Review of Significant Legislative, Judicial and Administrative Activities During 1977.
W80-03889 6E

WATER POLLUTION EFFECTS
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

A Nine-Year Study of the Phytoplankton of the Eutrophic and Non-Stratifying Loch Leven (Kinross, Scotland),
W80-03816 5C

Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica,
W80-03897 5C

WATER POLLUTION SOURCES
Trace Element Loading of Southern Lake Michigan by Dry Deposition of Atmospheric Aerosol,
W80-03621 5B

Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

The Influence of Urbanization of the Transport of Heavy Metals in New Jersey Streams,
W80-03774 5B

WATER POLLUTION TREATMENT
Nitrification-Denitrification of Wastewater,
W80-03610 5D

Method for Removing Suspended Oil Droplets from Water,
W80-03647 5D

WATER PURIFICATION
Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

WATER QUALITY
River-Quality Assessments.
W80-03606 5B

River-Quality Assessment--A Rational Scientific Basis for Pollution Control and Water-Quality Management,
W80-03607 5G

River-Quality Assessment: Concept, Framework, and Application in the Willamette River Basin, Oregon,
W80-03608 6B

An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

Toward a Conceptual Framework for River-Quality Trend and Cause-Effect Analysis,
W80-03611 5B

Dissolved Oxygen and Biochemical Oxygen Demand,
W80-03612 5A

Erosion Potential Assessment for the Willamette River Basin, Oregon,
W80-03613 7C

Algal Growth Potential--Lower Willamette River, Oregon,
W80-03614 5B

Comparison of Various Methods for Estimating the Quality of Water Based on Bottom-Dwelling Indicator Invertebrates,
W80-03673 5A

Zooplankters as Bioindicators of Water Quality,
W80-03678 5C

Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

Water Resources Data for Indiana, Water Year 1978.
W80-03752 7C

Water Resources Data for Alaska, Water Year 1978.
W80-03753 7C

Water Resources Data for Florida, Water Year 1978--Volume 3A-2. Southwest Florida Surface Water Quality.
W80-03755 7C

Water Resources Data for Florida, Water Year 1978--Volume 3B. Southwest Florida Ground Water.
W80-03756 7C

Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

Surface-Water Features in Osceola County and Adjacent Areas, Florida,
W80-03761 7C

Ground-Water Resources of Grant and Sioux Counties, North Dakota,
W80-03767 2F

Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78,
W80-03769 2F

Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

Effects of Mine Drainage on the River Hayle, Cornwall (A) Factors Affecting Concentrations of Copper, Zinc and Iron in Water, Sediments and Dominant Invertebrate Fauna,
W80-03891 5C

WATER QUALITY CONTROL
A Review of New Colorado Water and Air Pollution Legislation,
W80-03668 6E

Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

WATER QUALITY STANDARDS
Will Judicial Error Allow Industrial Point Sources to Avoid BPT and Perhaps BAT Later. A Story of Good Intentions, Bad Dictum, and Ugly Consequences,
W80-03885 6E

WATER RESOURCE DEVELOPMENT
Sale and Lease of Indian Water Rights,
W80-03880 6E

WATER RESOURCES
An Evaluation of Marginal Waters as a Natural Resource in Israel,
W80-03742 3C

Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

WATER RESOURCES DEVELOPMENT
American Bar Association Resolution Re Natural Resources of the Sea Adopted by the House of Delegates, August 6, 1973 and Report of the Section of Natural Resources Law Recommending Adoption of the Resolution.
W80-03695 6E

Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

WATER REUSE
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

Residential Water Reuse,
W80-03640 3D

An Evaluation of Marginal Waters as a Natural Resource in Israel,
W80-03742 3C

The Potential for Municipal Wastewater Reuse by Industry in Massachusetts,
W80-03747 3C

WATER RIGHTS
Public Water Supplies: The Effect of Federal and Tennessee Water Resource Law,
W80-03601 6E

The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

WATER-ROCK INTERACTION
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

WATER SUPPLY
Residential Water Reuse,
W80-03640 3D

Rangia Cuneata in An Industrial Water System (Bivalvia: Mactridae),
W80-03669 5A

An Interactive River Basin Water Management Model: Synthesis and Application,
W80-03708 6A

Development of Ground Water in the Houston District, Texas, 1970-74,
W80-03768 4B

The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

WATER TEMPERATURE
An Analysis of the Irreversible Thermodynamics Model for Coupled Heat and Moisture Transport Phenomena in Unsaturated Porous Media,
W80-03639 1A

Dependence of the Time of Gamete Maturation and Spawning on Environmental Temperature in the Virginia Oyster Crassostrea Virginica,
W80-03679 5C

The Relationship Between Vertebral Number and Water Temperature in Cod,
W80-03680 5A

The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

WATER TREATMENT
Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

Manganese Removal from Water by Flotation with Microgas Dispersions,
W80-03748 5F

WATER USER
The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

WATER UTILIZATION
Guidelines for Socioeconomic Impact Analyses of Environmental Regulations,
W80-03602 6C

WATER YIELD
Ground-Water Resources of Grant and Sioux Counties, North Dakota,
W80-03767 2F

WATERCHESTNUT
Impact of Nutrient Enrichment in a Waterchestnut Ecosystem at Takahama-Iri Bay of Lake Kasumigaura, Japan, II Role of Waterchestnut in Primary Productivity and Nutrient Uptake,
W80-03681 5B

WATERFOWL
Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands),
W80-03819 5C

WATERSHEDS (BASINS)
The Geomorphologic Structure of Hydrologic Response,
W80-03743 2A

Phosphrus Export from Rural Maine Watersheds,
W80-03776 5B

WAVE DAMPING
Damping of Gravity Waves over Porous Bed,
W80-03716 8B

WAVES (WATER)
Submarine Slide-Generated Water Waves in Kitimat Inlet, British Columbia,
W80-03627 2L

The Design and Use of an Oscillating Trolley Wave-Simulator, for Installation in Unidirectional Flow Flumes,
W80-03737 2L

WEIGHT
The Effects of Bottle Volume, Thallus Weight, Oxygen Saturation Levels, and Water Movement on Apparent Photosynthetic Rates in Marine Algae,
W80-03659 5C

WETLANDS
Wetlands of the South-West of Western Australia with Special Reference to the Busselton Area.
W80-03861 2L

Factors Affecting Tissue Nutrient Concentrations in a Scirpus-Equisetum Wetland,
W80-03876 2I

Interpretation of Unenhanced Landsat Imagery for Wetland and Land Use Delineation in the Texas Coastal Zone,
W80-03878 7C

WHISTLING SWAN
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

WILLAMETTE RIVER BASIN (OR)
River-Quality Assessments.
W80-03606 5B

River-Quality Assessment: Concept, Framework, and Application in the Willamette River Basin, Oregon,
W80-03608 6B

Erosion Potential Assessment for the Willamette River Basin, Oregon,
W80-03613 7C

WILLAMETTE RIVER (OR)
Algal Growth Potential--Lower Willamette River, Oregon,
W80-03614 5B

WILLINGNESS-TO-PAY
Estimating Willingness to Pay: Why and How.,
W80-03846 6B

WISCONSIN
Low-Flow Characteristics of Streams in the Pecatonica-Sugar River Basin, Wisconsin,
W80-03765 2E

WITHDRAWAL
Development of Ground Water in the Houston District, Texas, 1970-74,
W80-03768 4B

WORMS
The Distribution and Ecology of the Naididae (Oligochaeta) Which Inhabit the Filter-Beds of Sewage-Works in Britain,
W80-03666 5C

WYOMING
River-Quality Assessments.
W80-03606 5B

YAMPA RIVER BASIN (CO)
River-Quality Assessments.
W80-03606 5B

Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

YELLOWKNIFE RIVER (CANADA)
Seasonal Succession of Phytoplankton in a Large Subarctic River,
W80-03824 5C

ZINC
Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

ZOOPLANKTON
Zooplankters as Bioindicators of Water Quality,
W80-03678 5C

Zooplankton in a Quasi-Stable Phase in an Endorheic Lake (Lake Chilwa, Malawi),
W80-03807 5C

Two Electivity Indices for Feeding with Special Reference to Zooplankton Grazing,
W80-03810 5C

Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure,
W80-03815 5A

V
1
3
/
1
1
J
E
1
8
0
MI

AUTHOR INDEX

ABHYANKAR, V. P.
Does Precipitation Pattern Foretell Gujarat Climate Becoming Arid,
W80-03638 2B

ABRAHAM, G.
On the Magnitude of Interfacial Shear of Subcritical Stratified Flows in Relation with Interfacial Stability,
W80-03738 2E

AKRAM, M.
Infiltration of Soils as Affected by the Pressure and Water Content at the Time of Compaction,
W80-03722 2G

ALEKSEEV, V. V.
Very Simple Model of the Initial Stage of Oligotrophic-Eutrophic Succession. In Bodies of Water,
W80-03792 5A

ALEXANDER, V.
Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

ALLAN, R. B.
Interim Progress Report Supplement a -- Data Analysis, SCPP Data Collection and Analysis for the Period 1 January 1979 Through 30 June 1979,
W80-03779 3B

ALLER, R. C.
Particle Reworking in Sediments from the New York Bight Apex: Evidence from 234Th/238U Disequilibrium,
W80-03629 2J

ALMEIDA, C.
Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

ALMQUIST, C. W.
Staged Multiport Diffusers,
W80-03717 5B

AMARASINGHE, L.
The Ecology of a Saltmarsh in Sri Lanka,
W80-03871 2I

ANDERBERG, L. A. W.
The Anticipated Decision Influence Period in Real Time Reservoir Operation,
W80-03645 6A

ANDERSON, M. A.
The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

ANDERSON, T. M.
A New Approach for Salvinia Control,
W80-03827 4A

ANTSYFEROV, S. M.
Sediments Suspended in Stream Flow,
W80-03718 2J

ARNOLD, K. E.
Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

ATTWATER, W. R.
State Control Over Federal Reclamation Projects,
W80-03823 6E

AUCLAIR, N. D.
Factors Affecting Tissue Nutrient Concentrations in a Scirpus-Equisetum Wetland,
W80-03876 2I

AYERS, J. F.
Hydrology of Small Oceanic Islands--Utility of an Estimate of Recharge Inferred from the Chloride Concentration of the Freshwater Lenses,
W80-03729 2F

BAATH, E.
Effects of Artificial Acid Rain on Microbial Activity and Biomass,
W80-03688 5C

BABAJIMOPOULOS, C.
Formulating Lake Models Which Preserve Spectral Statistics,
W80-03605 2H

Verifying Lake Transport Models with Special Statistics,
W80-03836 2H

BABKINA, E. I.
Quantitative Extraction of Chlorinated Organic Pesticides and Polychlorinated Biphenyls from Fish Organs and Tissues,
W80-03674 5A

BAGWELL, M. R.
Effects of Mechanical Cutting on Submersed Vegetation in a Louisiana Lake,
W80-03832 4A

BAILARD, J. A.
A Reexamination of Bagnold's Granular-Fluid Model and Bed Load Transport Equation,
W80-03625 2J

BAILEY-WATTS, A. E.
A Nine-Year Study of the Phytoplankton of the Eutrophic and Non-Stratifying Loch Leven (Kinross, Scotland),
W80-03816 5C

BAINES, P. G.
Observations of Stratified Flow Past Three-Dimensional Barriers,
W80-03624 8B

BALASUBRAMANIAM, S.
The Ecology of a Saltmarsh in Sri Lanka,
W80-03871 2I

BALLANTINE, D. L.
The Distribution of Algal Epiphytes on Macrophyte Hosts Offshore from La Parguera, Puerto Rico,
W80-03797 5C

BARKO, J. W.
The Nutritional Ecology of Cyperus Esculentus, an Emergent Aquatic Plant, Grown on Different Sediments,
W80-03786 2I

BARNES, W. S.
Mutagenicity of Fluorene Derivatives: A Proposed Mechanism,
W80-03745 5A

BEATON, T. J.
Breathing New Life into Section 8 of the 1902 Reclamation Act: California V. United States,
W80-03814 6E

BEDFORD, K. W.
Formulating Lake Models Which Preserve Spectral Statistics,
W80-03605 2H

Verifying Lake Transport Models with Special Statistics,
W80-03836 2H

BENEMANN, J. R.
Nitrogen Fixation by Thermophilic Blue-Green Algae (Cyanobacteria): Temperature Characteristics and Potential Use in Biophotolysis,
W80-03796 5F

BENZ, M. C.
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

BERK, Z.
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

BERMINGHAM, J.
A Review of New Colorado Water and Air Pollution Legislation,
W80-03668 6E

BERRY, W. O.
Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

BHOWMIK, N. G.
Hydraulics of Flow in the Kaskaskia River, Illinois,
W80-03713 2E

BILLEN, G.
Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

BIRD, K.
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

BITTON, G.
On the Value of Soil Columns for Assessing the Transport Pattern of Viruses Through Soils: A Critical Outlook,
W80-03622 5B

BLASCO, D.
Two Phases of the Phytoplankton Community in the Baja California Upwelling,
W80-03805 5C

BOBOVNIKOVA, T. I.
Quantitative Extraction of Chlorinated Organic Pesticides and Polychlorinated Biphenyls from Fish Organs and Tissues,
W80-03674 5A

BOHLEN, W. F.
Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations,
W80-03631 2J

BOHM, P.
Estimating Willingness to Pay: Why and How.,
W80-03846 6B

BOLING, J. K.
Geophysical and Hydrologic Prediction of Fissuring and Land Subsidence, South-Central Arizona,
W80-03710 6A

BOLKE, E. L.
Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78,
W80-03769 2F

BOND, F. W.
A Parametric Model Calibrated with a Physically Based Model for Runoff Prediction from Ungaged Streams,
W80-03839 2E

BOURQUIN, A. W.
An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

BOWES, G.
Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

BOWMER, K. S.
Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

BOYCE, D.
Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

BOYD, E. L.
Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

BOZEMAN, B.
Financial Statement Modeling: Analyzing the Pollution-Control Tax Incentive,
W80-03850 6B

BRANDER, K.
The Relationship Between Vertebral Number and Water Temperature in Cod,
W80-03680 5A

BRANDES, M.
Characteristics of Effluents from Gray and Black Water Septic Tanks,
W80-03791 5B

BRAUN, H. E.
Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

BROTHERSON, J. D.
Diatom Floristics and Succession in a Peat Bog Near Lily Lake, Summit County, Utah,
W80-03872 2H

BROWN, B. E.
Effects of Mine Drainage on the River Hayle, Cornwall (A) Factors Affecting Concentrations of Copper, Zinc and Iron in Water, Sediments and Dominant Invertebrate Fauna,
W80-03891 5C

BROWN, D. E.
Legal and Institutional Factors Affecting Mariculture in Texas,
W80-03873 6E

BROWN, J. M. A.
Photosynthesis in the Aquatic Macrophyte Egeria Densa. III Gas Exchange Studies,
W80-03806 5C

BROWN, W. M. III.
Erosion Potential Assessment for the Willamette River Basin, Oregon,
W80-03613 7C

BROWSE, J. A.
Photosynthesis in the Aquatic Macrophyte Egeria Densa. III Gas Exchange Studies,
W80-03806 5C

BRUNNER, P. L.
Combined Sewer Overflow Treatment by Screening and Terminal Ponding -- Fort Wayne, Indiana,
W80-03656 5D

BRYANT, C. T.
Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

BUCK, C. E.
Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

BUCKWALTER, T. F.
Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

BURAS, N.
An Evaluation of Marginal Waters as a Natural Resource in Israel,
W80-03742 3C

BURGER, C. P.
Phytomechanics--Plant Physiology and Applied Mechanics,
W80-03780 2I

BURRELL, D. C.
The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica,
W80-03897 5C

BURROWS, P.
Pigovian Taxes, Polluter Subsidies, Regulation, and the Size of a Polluting Industry,
W80-03848 6E

BURTON, D. T.
The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

BUSBY, R. H.
The Convention for the Prevention of Marine Pollution from Land-Based Sources: An Effective Method for Arbitrating International Effluent Pollution Disputes,
W80-03887 6E

BUSHNELL, M.
Some Aspects of the Oceanography of the Gulf of Mexico Using Satellite and in Situ Data,
W80-03628 2L

CAIN, D.
Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

CAMPBELL, P. L.
Hydraulics of a Large Channel Paved with Boulders,
W80-03741 2E

CARPENTER, M. C.
Geophysical and Hydrologic Prediction of Fissuring and Land Subsidence, South-Central Arizona,
W80-03710 6A

CARTER, C. C.
Taxonomic Characteristics of Aquatic Plants from the Alimentary Tract of Grass Carp,
W80-03831 4A

CATTANEO, A.
The Microdistribution of Epiphytes on the Leaves of Natural and Artificial Macrophytes,
W80-03798 5C

CHADWICK, R. A.
Structural Controls of Hot-Spring Systems in Southwestern Montana,
W80-03760 1A

CHAPMAN, T.
Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

CHERRY, R. N.
An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

CHERY, D. L. JR.
A Parametric Model Calibrated with a Physically Based Model for Runoff Prediction from Ungaged Streams,
W80-03839 2E

CHOWDHURY, A.
Does Precipitation Pattern Foretell Gujarat Climate Becoming Arid,
W80-03638 2B

CLARK, J. A.
Flow Visualization in Complex Turbulent Flows,
W80-03715 8B

COBLE, R. W.
A Technique for Estimating Heights Reached by the 100-Year Flood on Unregulated, Nontidal Streams in North Carolina,
W80-03764 2E

COCHRAN, J. K.
Particle Reworking in Sediments from the New York Bight Apex: Evidence from 234Th/238U Disequilibrium,
W80-03629 2J

COLES, L.
Optimization of Unit Hydrograph Determination,
W80-03617 2E

COLLINS, M. B.
The Design and Use of an Oscillating Trolley Wave-Simulator, for Installation in Unidirectional Flow Flumes,
W80-03737 2L

COMBS, W. S. JR.
Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

CONNER, W. G.
The Effects of Oyster Shell Dredging on an Estuarine Benthic Community,
W80-03734 2L

COOK, N.
A Rainfall Simulator with Nonrepetitious Movement of Drop Outlets,
W80-03726 2B

CORWIN, D. L.
Adsorption-Desorption of Diuron by Freshwater Sediments,
W80-03838 5B

COUNTS, C. L. III.
Rangia Cuneata in An Industrial Water System (Bivalvia: Mactridae),
W80-03669 5A

CRAYTON, W. M.
Composition and Abundance of Phytoplankton in Tributaries of the Lower Colorado River, Grand Canyon Region,
W80-03890 5C

CRISSMAN, B. W.
Some Aspects of the Oceanography of the Gulf of Mexico Using Satellite and in Situ Data,
W80-03628 2L

CULP, R. L.
Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

CUNDY, D. F.
Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations,
W80-03631 2J

DAMARE, J. M.
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

DANE, J. H.
Effect of Tillage on Soil-Water Movement During Corn Growth,
W80-03724 2G

DAORAI, A.
Behavior of Abate in Microorganisms Isolated from Polluted Water,
W80-03892 5F

DARR, P.
An Evaluation of Marginal Waters as a Natural Resource in Israel,
W80-03742 3C

DATTA, P. S.
Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains,
W80-03636 2F

DAVIDSON, J. M.
On the Value of Soil Columns for Assessing the Transport Pattern of Viruses Through Soils: A Critical Outlook,
W80-03622 5B

DAVIS, D. L.
Contributions of Urban Land Use to Stream Water Quality,
W80-03644 5B

DAVIS, P.
Paul Spring: An Investigation of Recharge in the Roswell (NM) Artesian Basin,
W80-03642 2F

DAVIS, R. A. JR.
Surf Zone Dynamics During Upwelling on the Oregon Coast,
W80-03632 2L

DAVIS, S. N.
Geophysical and Hydrologic Prediction of Fissuring and Land Subsidence, South-Central Arizona,
W80-03710 6A

DAWES, C. J.
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

DAY, R. H.
Adaptive Economics and Natural Resources Policy,
W80-03854 6B

DE HAAN, H.
Effect of Benzoate on Microbial Decomposition of Fulvic Acids in Tjeukemeer (The Netherlands),
W80-03893 2K

DELUISE, F. J.
Manganese Removal from Water by Flotation with Microgas Dispersions,
W80-03748 5F

DEMINA, I. V.
Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

DENNO, R. F.
Comparison of the Assemblages of Sap-Feeding Insects (Homoptera-Hemiptera) Inhabiting Two Structurally Different Salt Marsh Grasses in the Genus Spartina,
W80-03881 2I

DESAI, B. I.
Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains,
W80-03636 2F

DEVITT, D.
Reclamation of Saline-Sodic Soils by Leaching,
W80-03723 2G

DIATLOFF, G.
A New Approach for Salvinia Control,
W80-03827 4A

DICKSON, D. A.
Early Growth of Picea Sitchensis (Bong.) Carr on Deep Oligotrophic Peat in Northern Ireland,
W80-03863 2I

DILOUIE, J. M. JR.
Erosional Aspects of Managing Urban Streams,
W80-03773 2J

DINKEL, D.
Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

DIXON, R. N.
The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

DODGE, C. H.
Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

DODSON, J. J.
Dynamics and Behavioral Toxicology of Aqua-Kleen (Trade Name) (2,4-D Butoxyethanol Ester) as Revealed by the Modification of Rheotropism in Rainbow Trout,
W80-03703 5A

DOLSKE, D. A.
Trace Element Loading of Southern Lake Michigan by Dry Deposition of Atmospheric Aerosol,
W80-03621 5B

DONTSOV, M. B.
The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

DREHWING, F. J.
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

DRNEVICH, R. F.
Nitrification-Denitrification of Wastewater,
W80-03610 5D

DROGUE, C.
Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

DROMGOOLE, F. I.
Photosynthesis in the Aquatic Macrophyte Egeria Densa. III Gas Exchange Studies,
W80-03806 5C

DRORI, M.
Flow Control Devices Particularly Useful for Drip Irrigation,
W80-03604 3F

DUINKER, J. C.
Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

DURAKO, M.
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

DURVE, V. S.
Fish Mortality and Fishing During an Unprecedented Draught in Lake Pichhola, Udaipur,
W80-03698 2H

DUSAUSKENE-DUZ, R. F.
Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

DWIVEDI, P.
Studies on the Effects of Acidic Medium on the Fry of Cyprinus Carpio,
W80-03706 5A

EAGLE, R. A.
The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

EDELSTEN, D. J.
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

EDWARDS, A.
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

EIDE, I.
Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

EINAV, P.
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

EISEMAN, N. J.
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

ELAM, R.
Financial Statement Modeling: Analyzing the Pollution-Control Tax Incentive,
W80-03850 6B

EMERSON, M. A.
Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

EPPLEY, R. W.
Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

ESCH, G. W.
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

ESTRADA, M.
Two Phases of the Phytoplankton Community in the Baja California Upwelling,
W80-03805 5C

EWEL, K. C.
Comparative Biomass and Growth of Cypress in Florida Wetlands,
W80-03866 2I

FARMER, W. J.
Adsorption-Desorption of Diuron by Freshwater Sediments,
W80-03838 5B

FARRAH, S. R.
On the Value of Soil Columns for Assessing the Transport Pattern of Viruses Through Soils: A Critical Outlook,
W80-03622 5B

FAYE, R. E.
An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

FEDOSEYENKO, V. M.
Eye Damage to the Grass Carp (Ctenopharyngodon Idella) from Chronic Uptake of Strontium 90,
W80-03697 5C

FELDHAKE, C. M.
Measuring Evapotranspiration of Turfgrass,
W80-03646 2D

FIDELL, E. R.
Liability for Oil Pollution - United States Law,
W80-03667 6E

FIERING, M. B.
Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

FINLEY, R. J.
Interpretation of Unenhanced Landsat Imagery for Wetland and Land Use Delineation in the Texas Coastal Zone,
W80-03878 7C

FISHER, J. W.
Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

FLEMMING, B. W.
Langebaan Lagoon: A Mixed Carbonate-Siliciclastic Tidal Environment in a Semi-Arid Climate,
W80-03865 2J

FLIERMANS, C. B.
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

FORBES, R. B.
Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

FOURNIER, R. O.
Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

FOX, J. D. JR.
Methods of Estimating Some Possible Interactions of Agricultural Development and Water Resources in Alaska,
W80-03711 2A

FOX, W. T.
Surf Zone Dynamics During Upwelling on the Oregon Coast,
W80-03632 2L

FRANK, R.
Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

FRANZEN, J. G.
A Cultural Resource Survey of the Teton Replacement Farmland, Jefferson County, Idaho,
W80-03778 6B

FRAZEE, J. M. JR.
Surface-Water Features in Osceola County and Adjacent Areas, Florida,
W80-03761 7C

FREEMAN, A. M. III.
Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues,
W80-03847 6B

GABRYSCH, R. K.
Development of Ground Water in the Houston District, Texas, 1970-74,
W80-03768 4B

GALLAHER, E. E.
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

GARNAS, R. L.
An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

GEORGE, C. B.
Measurements of Combined Oscillatory and Steady Flow Over a Rough Bed,
W80-03620 8B

GILL, M. A.
Hydraulics of Rectangular Vertical Drop Structures,
W80-03739 2E

GODDARD, R.
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

GOLDMAN, J. C.
Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter,
W80-03804 5C

GOPALAKRISHNAN, C.
Multinational Corporations, Nation-States and Ocean Resource Management: The Impact of the World's 200-Mile Economic Zone on Multinational and National Development,
W80-03859 6E

GORDEN, R. W.
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

GRANT, W. E.
A Bioeconomic Model of the Gulf of Mexico Shrimp Fishery,
W80-03845 8I

GRIFFIN, A. H.
The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

GRIFFIN, W. L.
A Bioeconomic Model of the Gulf of Mexico Shrimp Fishery,
W80-03845 8I

GRIFFITHS, F. B.
The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

GROSS, G. W.
Paul Spring: An Investigation of Recharge in the Roswell (NM) Artesian Basin,
W80-03642 2F

GROSSMAN, I. G.
Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

GRUBER, D. A.
Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

GUMERMAN, R. C.
Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

GUPTA, G. R.
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

GUPTA, S. K.
Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains,
W80-03636 2F

HAFSTEN, U.
Age, Origin, and Palaeo-Ecological Evidence of Blanket Bogs in Nord-Trondelag, Norway,
W80-03868 2J

HAKANSON, L.
An Empirical Model for Physical Parameters of Recent Sedimentary Deposits of Lake Ekoln and Lake Vanern,
W80-03790 5A

HALL, D. C.
Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

HALL, L. W. JR.
The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

HALLENBECK, P. C.
Nitrogen Fixation by Thermophilic Blue-Green Algae (Cyanobacteria): Temperature Characteristics and Potential Use in Biophotolysis,
W80-03796 5F

HALLER, W. T.
Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

HAMMOND, T. M.
The Design and Use of an Oscillating Trolley Wave-Simulator, for Installation in Unidirectional Flow Flumes,
W80-03737 2L

HANDMAN, E. H.
Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

HANSEN, C. A.
Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

HANUSOVA, J.
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

HARDEE, J.
Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

HARDIMAN, P. A.
The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

HARGETT, D.
Guidelines for Socioeconomic Impact Analyses of Environmental Regulations,
W80-03602 6C

HARGREAVES, N. B.
Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

HARRINGTON, J. J.
Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

HARRISON, P.
Spatial Aspects of the Pressure for Shoreline Development: The Example of Puget Sound,
W80-03884 6E

HARRISON, W. G.
Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

HASSETT, J. P. JR.
Sterols in Natural Water and Sediment,
W80-03900 5C

HAVENS, J. A.
An Analysis of the Irreversible Thermodynamics Model for Coupled Heat and Moisture Transport Phenomena in Unsaturated Porous Media,
W80-03639 1A

HAVLIK, B.
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

HAWKINS, D. B.
Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

HAY, C. H.
Experimental Ecology with Particular Reference to Proposed Commercial Harvesting of Durvillaea (Phaeophyta, Durvilleales) in New Zealand,
W80-03802 2I

HAZEN, T. C.
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

HAZLEWOOD, A.
The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

HEALY, J.
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

HEATH, D.
Environmental Quality and Economic Development,
W80-03857 6E

HEIDORN, K. C.
Incidents of Elevated Nitrate in Southern Ontario,
W80-03623 5B

HEINLE, D. R.
Carnivorous Feeding Behavior of the Adult Calanoid Copepod Acartia Tonsa Dana,
W80-03783 5C

HELLSTROM, T.
Flow in the Sea of Heavy Metals from a Smelter Industry,
W80-03788 5B

HENDERSON, T. J.
Interim Progress Report Supplement a -- Data Analysis, SCPP Data Collection and Analysis for the Period 1 January 1979 Through 30 June 1979,
W80-03779 3B

HESTAND, R. S.
Taxonomic Characteristics of Aquatic Plants from the Alimentary Tract of Grass Carp,
W80-03831 4A

HILLEBRAND, M. TH. J.
Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

HINES, W. G.
Toward a Conceptual Framework for River-Quality Trend and Cause-Effect Analysis,
W80-03611 5B

HIRA, G. S.
Influence of a Compact Zone on Solute Transport During Infiltration of Water,
W80-03727 2G

HIRSCH, R. M.
Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

HIRSCHBERG, D. J.
Recent Geochemical History of Flood Deposits in the Northern Chesapeake Bay,
W80-03735 2J

HOARE, R.
The Sublittoral Ecology of the Menai Strait, I. Temporal and Spatial Variation in the Fauna and Flora Along a Transect,
W80-03634 2L

HOFFMAN, W.
Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

HOK, C. I.
Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

HOLADAY, A. S.
Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

HOLDRINET, M.
Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

HOLLIGAN, P. M.
The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

HOLM, T. R.
The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

HOLTBY, L. B.
Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure,
W80-03815 5A

HOOD, M. A.
An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

HRUDEY, S. E.
Sources and Characteristics of Liquid Process Wastes from Arctic Offshore Hydrocarbon Exploration,
W80-03898 5C

HUGHES, G. H.
Surface-Water Features in Osceola County and Adjacent Areas, Florida,
W80-03761 7C

HUNTER, J. V.
Dissolved Oxygen and Biochemical Oxygen Demand,
W80-03612 5A

The Influence of Urbanization of the Transport of Heavy Metals in New Jersey Streams,
W80-03774 5B

HUSSONG, D.
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

INMAN, D. L.
A Reexamination of Bagnold's Granular-Fluid Model and Bed Load Transport Equation,
W80-03625 2J

ITO, K.
Phytosociological Studies of Uryu-Numa Mire Studies of Upland Bog Vegetation in Hokkaido (II), (In Japanese),
W80-03874 2I

IVERSON, D. G.
The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

IWAKI, H.
Impact of Nutrient Enrichment in a Waterchestnut Ecosystem at Takahama-Iri Bay of Lake Kasumigaura, Japan, II Role of Waterchestnut in Primary Productivity and Nutrient Uptake,
W80-03681 5B

JAMES, I. C. II
Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

JARRELL, W. M.
Reclamation of Saline-Sodic Soils by Leaching,
W80-03723 2G

JASRA, T. C.
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

JATKAR, S. A.
Diatom Floristics and Succession in a Peat Bog Near Lily Lake, Summit County, Utah,
W80-03872 2H

JENSEN, A.
Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

JOBSON, H. E.
Thermal Modeling of Highly Transient Flows in the Chattahoochee River Near Atlanta, Georgia,
W80-03615 2E

JOHNSON, D. B.
Phytomechanics--Plant Physiology and Applied Mechanics,
W80-03780 2I

JOHNSON, J. K.
Effects of Temperature and Salinity on Production and Hatching of Dormant Eggs of Acartia Californiensis (Copepoda) in an Oregon Estuary,
W80-03700 5A

JOHNSON, R. E.
Effects of Mechanical Cutting on Submersed Vegetation in a Louisiana Lake,
W80-03832 4A

JOHNSON, W. E.
Design of an Indirect Freezing Process Pilot Plant Based on Bulk Crystallization,
W80-03772 3A

JONES, D. A.
The Ecology of Sandy Beaches in Penang, Malaysia, with Special Reference to Excirolana Orientalis (Dana),
W80-03633 2L

JURKOVIC, A. A.
Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

JURY, W. A.
Reclamation of Saline-Sodic Soils by Leaching,
W80-03723 2G

KAFRI, U.
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

KALK, M.
Zooplankton in a Quasi-Stable Phase in an Endorheic Lake (Lake Chilwa, Malawi),
W80-03807 5C

KALUR, J. S.
Will Judicial Error Allow Industrial Point Sources to Avoid BPT and Perhaps BAT Later. A Story of Good Intentions, Bad Dictum, and Ugly Consequences,
W80-03885 6E

KANE, D. L.
Determination of Selected Hydraulic Properties of Subarctic Soils,
W80-03648 2G

Hydrologic Role of Shallow Organic Soils in Cold Climates,
W80-03649 2G

Snowmelt Infiltration Into Seasonally Frozen Soils,
W80-03650 2G

KANTOROWITZ, B.
Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

KARELSE, M.
On the Magnitude of Interfacial Shear of Subcritical Stratified Flows in Relation with Interfacial Stability,
W80-03738 2E

KARR, J. R.
Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

KAUFMAN, Z. F.
Dependence of the Time of Gamete Maturation and Spawning on Environmental Temperature in the Virginia Oyster Crassostrea Virginica,
W80-03679 5C

KEEFER, T. N.
Thermal Modeling of Highly Transient Flows in the Chattahoochee River Near Atlanta, Georgia,
W80-03615 2E

KEENEY, D. R.
Prediction of the Quality of Water in a Proposed Impoundment in Southwestern Wisconsin, USA,
W80-03801 5B

KEMP, A. L. W.
Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

KEMPER, W. D.
Infiltration of Soils as Affected by the Pressure and Water Content at the Time of Compaction,
W80-03722 2G

KENNEDY, E. M.
A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

KING, E. F.
The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

KING, W. J.
Some Aspects of the Oceanography of the Gulf of Mexico Using Satellite and in Situ Data,
W80-03628 2L

KIRKMAN, H.
The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

KLECKNER, R. L.
An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

KLEIJN, W. B.
A Rainfall Simulator with Nonrepetitious Movement of Drop Outlets,
W80-03726 2B

KLEKOWSKI, E.
Mutagenicity of Fluorene Derivatives: A Proposed Mechanism,
W80-03745 5A

Mutagens in a River Heavily Polluted with Paper Recycling Wastes: Results of Field and Laboratory Mutagen Assays,
W80-03746 5A

KNAUER, G. A.
Light Stimulation of Phosphate Uptake in Natural Assemblages of Phytoplankton,
W80-03821 5C

KNOLL, A. S.
Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

KNUTILLA, R. L.
Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

KOMARKOVA, J.
Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

KONAR, S. K.
Pesticides and Aquatic Ecosystems,
W80-03699 5C

KOS'YAN, R. D.
Sediments Suspended in Stream Flow,
W80-03718 2J

KOTSAR, N. I.
A Method for Studying the Excretory Function of Fish Kidneys Under Chronic Experimental Conditions,
W80-03675 5A

KRATZER, K.
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

KUSHNIKOVA, S. N.
Variation in the Reactions of Daphnia Magna Straus to the Effect of a Toxicant as Related to Its Delivery Regime,
W80-03676 5A

KUSUDA, R.
Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

KUZ'MIN, G. V.
Evaluation of Saprobicity of the Volgograd Reservoir in Terms of the Phytoplankton,
W80-03694 5C

KWIATKOWSKI, R. E.
Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

LAFLEN, J. M.
Soil and Water Losses from Corn-Soybean Rotations,
W80-03725 2J

LAING, R. L.
The Use of Multiple Inversion and Clean-Flo Lake Cleanser in Controlling Aquatic Plants,
W80-03828 4A

LAPERRIERE, J. D.
Methods of Estimating Some Possible Interactions of Agricultural Development and Water Resources in Alaska,
W80-03711 2A

LEAPHART, B.
Sale and Lease of Indian Water Rights,
W80-03880 6E

LEARNER, M. A.
The Distribution and Ecology of the Naididae (Oligochaeta) Which Inhabit the Filter-Beds of Sewage-Works in Britain,
W80-03666 5C

LEBEL, J.
Hydrochemistry of Dissolved Inorganic Carbon in the St. Lawrence Estuary (Canada),
W80-03736 2L

LEE, A. N.
A New Approach for Salvinia Control,
W80-03827 4A

LEE, G. F.
Sterols in Natural Water and Sediment,
W80-03900 5C

LEE, J. J.
A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

LEE, L. H. Y.
Flow Visualization in Complex Turbulent Flows,
W80-03715 8B

LEONARD, R. B.
Structural Controls of Hot-Spring Systems in Southwestern Montana,
W80-03760 1A

LEVIN, D. E.
Mutagenicity of Fluorene Derivatives: A Proposed Mechanism,
W80-03745 5A

Mutagens in a River Heavily Polluted with Paper Recycling Wastes: Results of Field and Laboratory Mutagen Assays,
W80-03746 5A

LEVITTE, D.
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

LIMPERT, R. J.
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

LINECK, T. S.
Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

LITSKY, W.
The Potential for Municipal Wastewater Reuse by Industry in Massachusetts,
W80-03747 3C

LITTLER, M. M.
The Effects of Bottle Volume, Thallus Weight, Oxygen Saturation Levels, and Water Movement on Apparent Photosynthetic Rates in Marine Algae,
W80-03659 5C

Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

LIVANSKY, K.
Semicontinuous Outdoor Cultivation of Scenedesmus Acutus in Waste Water,
W80-03705 5A

LIVINGSTONE, I.
The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

LOI, T-N.
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

LONSDALE, D. J.
Carnivorous Feeding Behavior of the Adult Calanoid Copepod Acartia Tonsa Dana,
W80-03783 5C

LUGO, A. E.
Structure of Mangrove Forests in Florida, Puerto Rico, Mexico, and Costa Rica,
W80-03879 2I

LUNDGREN, B.
Effects of Artificial Acid Rain on Microbial Activity and Biomass,
W80-03688 5C

LYFORD, F. P.
Ground Water in the San Juan Basin, New Mexico and Colorado,
W80-03763 2F

MACARTHUR, D. A.
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

MAGARITZ, M.
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

MANNING, J. H.
Establishment of Waterhyacinth Weevil Populations in Louisiana,
W80-03829 4A

MARDELL, G. T.
The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

MARGREY, S. L.
The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

MARK, A. F.
A Lowland Vegetation Sequence in South Westland: Pakihi Bog to Mixed Beech-Podocarp Forest. Part 1: The Principal Strata,
W80-03867 2I

MARTIN, D. L.
'One Person, One Vote' and California's Water Districts,
W80-03886 6E

MATSCH, L. C.
Nitrification-Denitrification of Wastewater,
W80-03610 5D

MAYFIELD, C. I.
Dynamics and Behavioral Toxicology of Aqua-Kleen (Trade Name) (2,4-D Butoxyethanol Ester) as Revealed by the Modification of Rheotropism in Rainbow Trout,
W80-03703 5A

MAYS, L. W.
Optimization of Unit Hydrograph Determination,
W80-03617 2E

MAZOR, E.
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

MAZOR, F.
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

MC GLEW, P. A.
Legal and Institutional Factors Affecting Mariculture in Texas,
W80-03873 6E

MCCAY, B. J.
Systems Ecology, People Ecology, and the Anthropology of Fishing Communities,
W80-03860 6B

MCENERY, M. E.
A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

MCGEHEE, J. T.
Mechanical Hydrilla Control in Orange Lake, Florida,
W80-03833 4A

MCLEAN, S. R.
Turbulence Measurements in the Boundary Layer Over a Sand Wave Field,
W80-03626 2E

MECKES, M. C.
Comparison of Ozone Contactors for Municipal Wastewater Effluent Disinfection -- Packed Column Versus Jet Scrubber,
W80-03653 5D

MEDINA, M. A.
Level III: Receiving Water Quality Modeling for Urban Stormwater Management,
W80-03657 5D

MEGARD, R. O.
Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

MEHRA, H. C.
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

MEIMAN, R.
Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

MEINHOLZ, T. L.
Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

MELSOM, S.
Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

MENDELSOHN, A. I.
Liability for Oil Pollution - United States Law,
W80-03667 6E

MENZER, R. E.
Behavior of Abate in Microorganisms Isolated from Polluted Water,
W80-03892 5F

MEREZHKO, A. I.
The Absorption of DDT by Vascular Aquatic Plants,
W80-03663 5B

The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

MICHAEL, R. J.
Litigation of the Reclamation Law in the Imperial Valley: Who Has Standing to Challenge Which Law,
W80-03888 3F

MILLER, E. E.
A Hysteresis Model Based on an Explicit Domain-Dependence Function,
W80-03720 2G

MILNE, M.
Residential Water Reuse,
W80-03640 3D

MILSTEAD, C. E.
Low Pressure Brackish Water Reverse Osmosis Membrane Development - Final Report,
W80-03749 3A

MILTON, P.
The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

MITCHELL, D. S.
Assessment of Aquatic Weed Problems,
W80-03826 4A

Formulating Aquatic Weed Management Programs,
W80-03841 4A

MITSCH, W. J.
Comparative Biomass and Growth of Cypress in Florida Wetlands,
W80-03866 2I

MIYAKE, Y.
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

MIYAMOTO, K.
Nitrogen Fixation by Thermophilic Blue-Green Algae (Cyanobacteria): Temperature Characteristics and Potential Use in Biophotolysis,
W80-03796 5F

MOAZZAM, M.
Species Composition and Seasonal Occurence of Centric Diatoms in a Polluted Marine Environment,
W80-03820 5C

MOFFA, P. E.
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

MOKADY, S.
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

MOL-KRIJNEN, J. C. M.
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

MOLDENHAUER, W. C.
Soil and Water Losses from Corn-Soybean Rotations,
W80-03725 2J

MOORE, J. W.
Seasonal Succession of Phytoplankton in a Large Subarctic River,
W80-03824 5C

MOROZ, T. G.
Comparison of Various Methods for Estimating the Quality of Water Based on Bottom-Dwelling Indicator Invertebrates,
W80-03673 5A

MORRIS, E. E.
Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

MORRIS, N. C. G.
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

MOSER, J. H.
Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

MUALEM, Y.
A Hysteresis Model Based on an Explicit Domain-Dependence Function,
W80-03720 2G

MURRAY, S. N.
Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

MURTY, T. S.
Submarine Slide-Generated Water Waves in Kitimat Inlet, British Columbia,
W80-03627 2L

MUYS, J. C.
The Federal Reserved Rights Doctrine - from 1866 Through Eagle County,
W80-03777 6E

NADLER, A.
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

NEVE, R. A.
Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

NEWROTH, P. R.
British Columbia Aquatic Plant Management Program,
W80-03840 4A

NIENHUIS, P. H.
Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands),
W80-03819 5C

NIKOLAI, L. A.
Financial Statement Modeling: Analyzing the Pollution-Control Tax Incentive,
W80-03850 6B

NILOV, V. I.
Eye Damage to the Grass Carp (Ctenopharyngodon Idella) from Chronic Uptake of Strontium 90,
W80-03697 5C

NISSENBAUM, A.
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

NORTON, M. G.
The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

NUNNY, R. S.
The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

O'BRIEN, R. T.
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

OGATA, M.
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

OKHAPKIN, A. G.
Evaluation of Saprobicity of the Volgograd Reservoir in Terms of the Phytoplankton,
W80-03694 5C

OLIVER, A. J.
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

ONDOK, J. P.
Photosynthetically Active Radiation in a Stand of Phragmites Communis Trin. II. Model of Light Extinction in the Stand,
W80-03869 2H

OPATKEN, E. J.
Comparison of Ozone Contactors for Municipal Wastewater Effluent Disinfection -- Packed Column Versus Jet Scrubber,
W80-03653 5D

ORCIARI, R. D.
Rotenone Resistance of Golden Shiners from a Periodically Reclaimed Pond,
W80-03702 5A

OSBORNE, J. A.
Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

OSTER, J. D.
A Rainfall Simulator with Nonrepetitious Movement of Drop Outlets,
W80-03726 2B

OTTE, G.
Investigations on the Effects of Domestic Sewage on the Benthic Ecosystem of Marine Intertidal Flats (In German),
W80-03684 5C

PAINTER, H. A.
The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

PARKER, R. R.
The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

PARKHOMENKO, A. V.
Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

PEATTIE, M. E.
The Sublittoral Ecology of the Menai Strait, I. Temporal and Spatial Variation in the Fauna and Flora Along a Transect,
W80-03634 2L

PECK, D. E.
Adsorption-Desorption of Diuron by Freshwater Sediments,
W80-03838 5B

PELLETIER, E.
Hydrochemistry of Dissolved Inorganic Carbon in the St. Lawrence Estuary (Canada),
W80-03736 2L

PEMADASA, M. A.
The Ecology of a Saltmarsh in Sri Lanka,
W80-03871 2I

PESCH, C.
Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

PESCH, G.
Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

PETERSEN, R.
Algal Growth Potential--Lower Willamette River, Oregon,
W80-03614 5B

PETHIG, R.
Environmental Management in General Equilibrium: A New Incentive Compatible Approach,
W80-03855 6B

PINGREE, R. D.
The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

POLIKARPOV, G. G.
Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

POLIVANNAYA, M. F.
Zooplankters as Bioindicators of Water Quality,
W80-03678 5C

POLYAKOVA, M. S.
Very Simple Model of the Initial Stage of Oligotrophic-Eutrophic Succession. In Bodies of Water,
W80-03792 5A

PONCE, L.
Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

POOL, D. J.
Structure of Mangrove Forests in Florida, Puerto Rico, Mexico, and Costa Rica,
W80-03879 2I

POTTERTON, R. S. JR.
Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

PRAH, D. H.
Combined Sewer Overflow Treatment by Screening and Terminal Ponding -- Fort Wayne, Indiana,
W80-03656 5D

V 13 / 11 1 J E 1 8 0 UMI

PRASILOVA, J.
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

PRATTE, J.
The Potential for Municipal Wastewater Reuse by Industry in Massachusetts,
W80-03747 3C

PROKES, B.
Semicontinuous Outdoor Cultivation of Scenedesmus Acutus in Waste Water,
W80-03705 5A

PURI, K. K.
Damping of Gravity Waves over Porous Bed,
W80-03716 8B

PUSHCHINA, L. I.
The Effect of the Degree of Mineralization of Water on Phytoplankton,
W80-03664 5A

PYTLAR, T. S. JR.
Erosional Aspects of Managing Urban Streams,
W80-03773 2J

QUINN, J. G.
Incorporation, Distribution and Fate of Saturated Petroleum Hydrocarbons in Sediments from a Controlled Marine Ecosystem,
W80-03899 5C

RABE, F. W.
Stream Types in Idaho: An Approach to Classification of Streams in Natural Areas,
W80-03835 6B

RACE, R. A.
Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

RAISCH, J.
A Review of New Colorado Water and Air Pollution Legislation,
W80-03668 6E

RAJBANSHI, V. K.
Fish Mortality and Fishing During an Unprecedented Draught in Lake Pichhola, Udaipur,
W80-03698 2H

RANDAZZO, A. F.
Geohydrologic Model of the Floridan Aquifer in the Southwest Florida Water Management District,
W80-03751 2F

RANDICH, P. G.
Ground-Water Resources of Grant and Sioux Counties, North Dakota,
W80-03767 2F

RAO, S. S.
Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

RAYMOND, H. L.
Effects of Dams and Impoundments on Migrations of Juvenile Chinook Salmon and Steelhead from the Snake River, 1966 to 1975,
W80-03701 5A

RAZACK, M.
Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

REHFELDT, K. R.
Paul Spring: An Investigation of Recharge in the Roswell (NM) Artesian Basin,
W80-03642 2F

RENDA, C. R.
Owner Eligibility Restrictions - Acreage and Residency,
W80-03883 6E

RENGER, E. H.
Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

RESHKIN, S. J.
Light Stimulation of Phosphate Uptake in Natural Assemblages of Phytoplankton,
W80-03821 5C

RICKERT, D. A.
River-Quality Assessment: Concept, Framework, and Application in the Willamette River Basin, Oregon,
W80-03608 6B

Toward a Conceptual Framework for River-Quality Trend and Cause-Effect Analysis,
W80-03611 5B

RILEY, R. L.
Low Pressure Brackish Water Reverse Osmosis Membrane Development - Final Report,
W80-03749 3A

ROBERTS, H. H.
Holocene Sedimentation at Cape Sable, South Florida,
W80-03864 2J

ROBERTSON, R. J.
Optimal Niche Space of the Redwinged Blackbird (Agelaius Phoeniceus), I. Nesting Success in Marsh and Upland Habitat,
W80-03875 2I

RODRIGUEZ-ITURBE, I.
The Geomorphologic Structure of Hydrologic Response,
W80-03743 2A

ROGERS, P. P.
Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

ROLLINS, H. C.
Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

ROLSTON, J. L.
Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

ROMANANKO, V. D.
A Method for Studying the Excretory Function of Fish Kidneys Under Chronic Experimental Conditions,
W80-03675 5A

ROMARIZ, C.
Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

ROZHANSKAYA, L. I.
Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

RUBIN, H.
A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

RUSHFORTH, S. R.
Diatom Floristics and Succession in a Peat Bog Near Lily Lake, Summit County, Utah,
W80-03872 2H

RUSSELL, C. S.
What Can We Get From Effluent Charges,
W80-03849 6B

SACHS, K.
Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

SACKINGER, W. M.
An Overview of Offshore Environmental Pollution Laws and Regulations in Canada, Greenland, and the North Sea,
W80-03896 5C

SAIFULLAH, S. M.
Species Composition and Seasonal Occurence of Centric Diatoms in a Polluted Marine Environment,
W80-03820 5C

SAINTY, G. R.
Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

SAKO, H.
Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

SALIH, A. M. A.
Air Bubbles in a Convectively Accelerated Water Flow,
W80-03740 8B

SASEKUMAR, A.
Distribution of Macrofauna on a Malayan Mangrove Shore,
W80-03870 2I

SASSIC, N. M.
Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

SASTRY, K. V.
In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

SAVAGE, N. L.
Stream Types in Idaho: An Approach to Classification of Streams in Natural Areas,
W80-03835 6B

SAVILL, P. S.
Early Growth of Picea Sitchensis (Bong.) Carr on Deep Oligotrophic Peat in Northern Ireland,
W80-03863 2I

SCAVIA, D.
Two Electivity Indices for Feeding with Special Reference to Zooplankton Grazing,
W80-03810 5C

SCHEFTER, J. E.
Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

SCHINER, G. R.
Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

SCHLOSSER, I. J.
Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

SCHROEDER, D. C.
Phosphrus Export from Rural Maine Watersheds,
W80-03776 5B

SCHUBEL, J. R.
Recent Geochemical History of Flood Deposits in the Northern Chesapeake Bay,
W80-03735 2J

SCOTT, B. D.
Phytoplankton Distribution and Light Attenuation in Port Hacking Estuary,
W80-03799 5C

SEN, Z.
Statistical Analysis of Hydrologic Critical Droughts,
W80-03618 2E

SERGEYEVA, O. A.
Zooplankters as Bioindicators of Water Quality,
W80-03678 5C

SHAFER, J. M.
An Interactive River Basin Water Management Model: Synthesis and Application,
W80-03708 6A

SHANKS, V.
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

SHAPIRO, S. P.
Environmental Protection for Whom,
W80-03853 6B

SHARMA, K.
In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

SHAW, K.
Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

SHEKHANOVA, I. A.
Eye Damage to the Grass Carp (Ctenopharyngodon Idella) from Chronic Uptake of Strontium 90,
W80-03697 5C

SHOKOD'KO, T. I.
The Absorption of DDT by Vascular Aquatic Plants,
W80-03663 5B

The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

SHRIVASTAVA, R. S.
Studies on the Effects of Acidic Medium on the Fry of Cyprinus Carpio,
W80-03706 5A

SIEGFRIED, C.
Carnivorous Feeding Behavior of the Adult Calanoid Copepod Acartia Tonsa Dana,
W80-03783 5C

SIEVERING, H.
Trace Element Loading of Southern Lake Michigan by Dry Deposition of Atmospheric Aerosol,
W80-03621 5B

SIKORA, V. A.
Public Water Supplies: The Effect of Federal and Tennessee Water Resource Law,
W80-03601 6E

SIMON, J. L.
The Effects of Oyster Shell Dredging on an Estuarine Benthic Community,
W80-03734 2L

SIMPSON, E. S.
A Parametric Model Calibrated with a Physically Based Model for Runoff Prediction from Ungaged Streams,
W80-03839 2E

SIMPSON, J. H.
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

SINGH, N. T.
Influence of a Compact Zone on Solute Transport During Infiltration of Water,
W80-03727 2G

SLADEN, W. J. L.
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

SLAUGHTER, C. W.
Hydrologic Role of Shallow Organic Soils in Cold Climates,
W80-03649 2G

SLEATH, J. F. A.
Measurements of Combined Oscillatory and Steady Flow Over a Rough Bed,
W80-03620 8B

SMART, R. M.
The Nutritional Ecology of Cyperus Esculentus, an Emergent Aquatic Plant, Grown on Different Sediments,
W80-03786 2I

SMIRNOVA, N. N.
The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

SMITH, A. A.
A Generalized Approach to Kinematic Flood Routing,
W80-03732 2E

SMITH, G.
Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

SMITH, J. D.
Turbulence Measurements in the Boundary Layer Over a Sand Wave Field,
W80-03626 2E

SMITH, P. D.
Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

SMITH, P. M. F.
A Lowland Vegetation Sequence in South Westland: Pakihi Bog to Mixed Beech-Podocarp Forest. Part 1: The Principal Strata,
W80-03867 2I

SMITH, T. J.
On the Calculation of the Width Averaged Flow Due to Long Waves in an Open Channel,
W80-03619 2E

SMITH, W. G.
Holocene Sedimentation at Cape Sable, South Florida,
W80-03864 2J

SNEDAKER, S. C.
Structure of Mangrove Forests in Florida, Puerto Rico, Mexico, and Costa Rica,
W80-03879 2I

SNYDER, R. M.
Tidal Hydraulics in Estuarine Channels,
W80-03714 2L

SODERSTROM, B.
Effects of Artificial Acid Rain on Microbial Activity and Biomass,
W80-03688 5C

SOLAK, M. E.
Interim Progress Report Supplement a -- Data Analysis, SCPP Data Collection and Analysis for the Period 1 January 1979 Through 30 June 1979,
W80-03779 3B

SOLEM, T.
Age, Origin, and Palaeo-Ecological Evidence of Blanket Bogs in Nord-Trondelag, Norway,
W80-03868 2J

SOLLY, S. R. B.
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

SOMMERFELD, M. R.
Composition and Abundance of Phytoplankton in Tributaries of the Lower Colorado River, Grand Canyon Region,
W80-03890 5C

SOUTH, G. R.
Experimental Ecology with Particular Reference to Proposed Commercial Harvesting of Durvillaea (Phaeophyta, Durvilleales) in New Zealand,
W80-03802 2I

SPEARNAK, M.
Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

SPROUL, O. J.
Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

SPRULES, W. G.
Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure,
W80-03815 5A

SRIVASTAVA, K. K.
Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

STAMER, J. K.
An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

STANFORTH, R. R.
The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

STARY, J.
Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

STEDFAST, D. A.
Low-Flow Characteristics of Streams in the Pecatonica-Sugar River Basin, Wisconsin,
W80-03765 2E

STEWART, N.
Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

STOLZENBACH, K. D.
Staged Multiport Diffusers,
W80-03717 5B

STRASKRABOVA, V.
Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

SULLIVAN, M. J.
Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

SUNDAY, G. K.
Role of Rill Development in Salt Loading from Hillslopes,
W80-03643 2J

SUTINEN, J. G.
Fishermen's Remuneration Systems and Implications for Fisheries Development,
W80-03858 6C

TABATA, T.
Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

TAKHAR, H. S.
On the Calculation of the Width Averaged Flow Due to Long Waves in an Open Channel,
W80-03619 2E

TAYLOR, D.
A Review of the Lethal and Sub-Lethal Effects of Mercury on Aquatic Life,
W80-03683 5A

TERRY, J. E.
Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

TETT, P. B.
The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

THOMAS, R. L.
Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

THOMPSON, S. M.
Hydraulics of a Large Channel Paved with Boulders,
W80-03741 2E

TRAMONTANO, J. M.
Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations,
W80-03631 2J

TRUESDELL, A. H.
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

TSUCHIYA, T.
Impact of Nutrient Enrichment in a Waterchestnut Ecosystem at Takahama-Iri Bay of Lake Kasumigaura, Japan, II Role of Waterchestnut in Primary Productivity and Nutrient Uptake,
W80-03681 5B

TUERKHEIMER, F. M.
Copper Mining from Under Lake Superior: The Legal Aspects,
W80-03759 6E

TURNER, J. C.
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

TYNAN, T. M.
Canadian-American Relations in the Arctic: The Effect of Environmental Influences Upon Territorial Claims,
W80-03852 6E

UMEZAWA, A.
Phytosociological Studies of Uryu-Numa Mire Studies of Upland Bog Vegetation in Hokkaido (II), (In Japanese),
W80-03874 2I

VACCARO, J. V.
Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78,
W80-03769 2F

VACHER, H. L.
Hydrology of Small Oceanic Islands--Utility of an Estimate of Recharge Inferred from the Chloride Concentration of the Freshwater Lenses,
W80-03729 2F

VALDES, J. B.
The Geomorphologic Structure of Hydrologic Response,
W80-03743 2A

VAN DET, M.
Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

VAN IERLAND, E. T.
Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands),
W80-03819 5C

VAN OS, A. G.
On the Magnitude of Interfacial Shear of Subcritical Stratified Flows in Relation with Interfacial Stability,
W80-03738 2E

VANDERPLOEG, H. A.
Two Electivity Indices for Feeding with Special Reference to Zooplankton Grazing,
W80-03810 5C

VEBER, K.
Semicontinuous Outdoor Cultivation of Scenedesmus Acutus in Waste Water,
W80-03705 5A

VELZ, C. J.
River-Quality Assessment--A Rational Scientific Basis for Pollution Control and Water-Quality Management,
W80-03607 5G

VENKATARAMAN, S.
On the Assessment of Crop Droughts: A Case Study for Disa (Gujarat),
W80-03637 2B

VENOSA, A. D.
Comparison of Ozone Contactors for Municipal Wastewater Effluent Disinfection -- Packed Column Versus Jet Scrubber,
W80-03653 5D

VUKOVICH, F. M.
Some Aspects of the Oceanography of the Gulf of Mexico Using Satellite and in Situ Data,
W80-03628 2L

WADE, J. C.
The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

WADE, T. L.
Incorporation, Distribution and Fate of Saturated Petroleum Hydrocarbons in Sediments from a Controlled Marine Ecosystem,
W80-03899 5C

WAITE, D. T.
A Periphyton Growth Substrate Useful for Nutrient Impact Studies in Large Rivers,
W80-03665 5A

WALSH, D.
Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

WALSTON, R.
Reborn Federalism in Western Water Law: The New Melones Dam Decision,
W80-03795 6E

WEATHERLY, A. B.
Effect of Tillage on Soil-Water Movement During Corn Growth,
W80-03724 2G

WEIHS, D. L.
The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica,
W80-03897 5C

WEINER, R. M.
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

WESTMAN, W. E.
Pattern and Diversity in Swamp and Dune Vegetation, North Stradbroke Island,
W80-03882 2I

WHELAN, T.
Holocene Sedimentation at Cape Sable, South Florida,
W80-03864 2J

WHIPPLE, W. JR.
Erosional Aspects of Managing Urban Streams,
W80-03773 2J

WHITE, H. S.
Effects of Dinoflagellate Bioluminescence on the Ingestion Rates of Herbivorous Zooplankton,
W80-03782 5C

WHITE, I.
Measured and Approximate Flux-Concentration Relations for Absorption of Water by Soil,
W80-03721 2G

WIJEWANSA, H. G.
The Ecology of a Saltmarsh in Sri Lanka,
W80-03871 2I

WILBER, W. G.
The Influence of Urbanization of the Transport of Heavy Metals in New Jersey Streams,
W80-03774 5B

WILLIAMS, O. R.
Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

WILLIAMS, R. E.
Method for Removing Suspended Oil Droplets from Water,
W80-03647 5D

WILSON, B. J.
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

WILSON, J. S.
Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

WINFREY, M. R.
Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

Microbial Methanogenesis and Acetate Metabolism in a Meromictic Lake,
W80-03813 2H

WOLLAST, R.
Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

WORTHINGTON, P. F.
Preparation of Friable Aquiferous Specimens,
W80-03719 8E

YANNAI, S.
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

YANNAI, S.

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

YAP, C. L.
Employment in the Fishing Industry: Some Preliminary Findings on Fishermen's Mobility,
W80-03856 6F

YEAGER, J. G.
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

ZEIKUS, J. G.
Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

Microbial Methanogenesis and Acetate Metabolism in a Meromictic Lake,
W80-03813 2H

ORGANIZATIONAL INDEX

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, BENEDICT, MD. BENEDICT ESTUARINE RESEARCH LAB.
The Influence of Acclimation Temperature on the Interactions of Chlorine, Elevated Temperature, and Exposure Duration for Grass Shrimp, Palaemonetes Pugio,
W80-03704 5A

ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, PA.
Macroinfaunal Structure and Effects of Thermal Discharges in a Mesohaline Habitat of Chesapeake Bay, Near a Nuclear Power Plant,
W80-03672 5C

AEROSPACE MEDICAL RESEARCH LAB., WRIGHT-PATTERSON AFB, OH.
Transfer of 14C-Toluene from Mosquito Larvae to Bluegill Sunfish,
W80-03686 5B

AHMADU BELLO UNIV., ZARIA (NIGERIA). DEPT. OF CIVIL ENGINEERING.
Hydraulics of Rectangular Vertical Drop Structures,
W80-03739 2E

AKADEMIYA NAUK KAZAKHSKOI SSR, ALMA-ATA. INST. ZOOLOGII.
Eye Damage to the Grass Carp (Ctenopharyngodon Idella) from Chronic Uptake of Strontium 90,
W80-03697 5C

AKADEMIYA NAUK SSSR, BOROK. INST. BIOLOGII VNUTRENNYKH VOD.
Evaluation of Saprobicity of the Volgograd Reservoir in Terms of the Phytoplankton,
W80-03694 5C

AKADEMIYA NAUK SSSR, MOSCOW. INST. OKEANOLOGII.
Sediments Suspended in Stream Flow,
W80-03718 2J

AKADEMIYA NAUK SSSR, PETROZAVODSK. DEPT. OF WATER PROBLEMS.
Dependence of the Time of Gamete Maturation and Spawning on Environmental Temperature in the Virginia Oyster Crassostrea Virginica,
W80-03679 5C

AKADEMIYA NAUK URSR, KIEV. INST. HIDROBIOLOGII.
The Reaction of Phragmites Communis Roots to DDT and Hexachlorane,
W80-03661 5C

The Absorption of DDT by Vascular Aquatic Plants,
W80-03663 5B

A Method for Studying the Excretory Function of Fish Kidneys Under Chronic Experimental Conditions,
W80-03675 5A

Zooplankters as Bioindicators of Water Quality,
W80-03678 5C

ALASKA UNIV., FAIRBANKS. GEOPHYSICAL INST.
An Overview of Offshore Environmental Pollution Laws and Regulations in Canada, Greenland, and the North Sea,
W80-03896 5C

ALASKA UNIV., FAIRBANKS. INST. OF MARINE SCIENCE.
Effects of Oil on Marine Phytoplankton Communities,
W80-03895 5C

The Transfer of Cadmium from Marine Heterotrophic Bacteria to Macoma Balthica,
W80-03897 5C

ALASKA UNIV., FAIRBANKS. INST. OF WATER RESOURCES.
Determination of Selected Hydraulic Properties of Subarctic Soils,
W80-03648 2G

Snowmelt Infiltration Into Seasonally Frozen Soils,
W80-03650 2G

Methods of Estimating Some Possible Interactions of Agricultural Development and Water Resources in Alaska,
W80-03711 2A

Geology and Geochemistry of Arsenic, Ester Dome Area, Alaska,
W80-03712 2K

ALBERTA UNIV., EDMONTON. DEPT. OF CIVIL ENGINEERING.
Sources and Characteristics of Liquid Process Wastes from Arctic Offshore Hydrocarbon Exploration,
W80-03898 5C

AMERICAN BAR ASSOCIATION, WASHINGTON, DC. NATURAL RESOURCES LAW SECTION.
Marine Resources Committee-Annual Review of Significant Legislative, Judicial and Administrative Activities During 1977.
W80-03889 6E

AMERICAN BAR ASSOCIATION, WASHINGTON, DC. NATURAL RESOURCES SECTION.
American Bar Association Resolution Re Natural Resources of the Sea Adopted by the House of Delegates, August 6, 1973 and Report of the Section of Natural Resources Law Recommending Adoption of the Resolution.
W80-03695 6E

ARIZONA STATE UNIV., TEMPE. DEPT. OF BOTANY AND MICROBIOLOGY.
Composition and Abundance of Phytoplankton in Tributaries of the Lower Colorado River, Grand Canyon Region,
W80-03890 5C

ARIZONA UNIV., TUCSON. DEPT. OF AGRICULTURAL ECONOMICS.
The Economic Consequences of Allocating Groundwater to Competing Interest in the Santa Cruz Basin, Pima County, Arizona,
W80-03707 6E

ARIZONA UNIV., TUCSON. DEPT. OF HYDROLOGY AND WATER RESOURCES.
Geophysical and Hydrologic Prediction of Fissuring and Land Subsidence, South-Central Arizona,
W80-03710 6A

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF CHEMICAL ENGINEERING.
An Analysis of the Irreversible Thermodynamics Model for Coupled Heat and Moisture Transport Phenomena in Unsaturated Porous Media,
W80-03639 1A

ARMY ENGINEER DISTRICT, JACKSONVILLE, FL.
Mechanical Hydrilla Control in Orange Lake, Florida,
W80-03833 4A

ARMY ENGINEER WATERWAYS EXPERIMENTAL STATION, VICKSBURG, MS. ENVIRONMENTAL LAB.
The Nutritional Ecology of Cyperus Esculentus, an Emergent Aquatic Plant, Grown on Different Sediments,
W80-03786 2I

ATMOSPHERICS INC., FRESNO, CA.
Interim Progress Report Supplement a -- Data Analysis, SCPP Data Collection and Analysis for the Period 1 January 1979 Through 30 June 1979,
W80-03779 3B

AUBURN UNIV., AL.
'One Person, One Vote' and California's Water Districts,
W80-03886 6E

AUBURN UNIV., ALABAMA. DEPT. OF AGRONOMY AND SOILS.
Effect of Tillage on Soil-Water Movement During Corn Growth,
W80-03724 2G

AUCKLAND UNIV. (NEW ZEALAND). DEPT. OF BOTANY.
Photosynthesis in the Aquatic Macrophyte Egeria Densa. III Gas Exchange Studies,
W80-03806 5C

BALTIMORE DISTRICT, U.S. ARMY CORPS OF ENGINEERS, BALTIMORE, MARYLAND, CORPS OF ENGINEERS, BALTIMORE, MD. BALTIMORE DISTRICT.
Chesapeake Bay Future Conditions Report. Appendix 3. Economic and Social Profile.
W80-03844 6B

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA.
A Parametric Model Calibrated with a Physically Based Model for Runoff Prediction from Ungaged Streams,
W80-03839 2E

BECHTEL CORP., SAN FRANCISCO, CA. RESEARCH AND ENGINEERING.
Technical and Economic Assessment of Solar Distillation for Large Scale Production in Fresh Water.
W80-03842 3A

BOWDOIN COLL., BRUNSWICK, ME.
Hedonic Prices, Property Values and Measuring Environmental Benefits: A Survey of the Issues,
W80-03847 6B

BRIGHAM YOUNG UNIV., PROVO, UT. DEPT. OF BOTANY AND RANGE SCIENCE.
Diatom Floristics and Succession in a Peat Bog Near Lily Lake, Summit County, Utah,
W80-03872 2H

CALIFORNIA INST. OF TECH., PASADENA. ENVIRONMENTAL QUALITY LAB.
Erosion Potential Assessment for the Willamette River Basin, Oregon,
W80-03613 7C

CALIFORNIA STATE DEPT. OF WATER RESOURCES, SACRAMENTO.
Index to Sources of Hydrologic Data,
W80-03744 7C

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD, SACRAMENTO.
State Control Over Federal Reclamation Projects,
W80-03823 6E

CALIFORNIA UNIV., BERKELEY. SANITARY ENGINEERING RESEARCH LAB.
Nitrogen Fixation by Thermophilic Blue-Green Algae (Cyanobacteria): Temperature Characteristics and Potential Use in Biophotolysis,
W80-03796 5F

CALIFORNIA UNIV., IRVINE.
The Effects of Bottle Volume, Thallus Weight, Oxygen Saturation Levels, and Water Movement on Apparent Photosynthetic Rates in Marine Algae,
W80-03659 5C

CALIFORNIA UNIV., IRVINE. DEPT. OF ECOLOGY AND EVOLUTIONARY BIOLOGY.
Seasonal Variations in Net Photosynthetic Performance and Cover of Intertidal Macrophytes,
W80-03660 5C

CALIFORNIA UNIV., LOS ANGELES. SCHOOL OF ARCHITECTURE AND URBAN PLANNING.
Residential Water Reuse,
W80-03640 3D

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.
Reclamation of Saline-Sodic Soils by Leaching,
W80-03723 2G

Adsorption-Desorption of Diuron by Freshwater Sediments,
W80-03838 5B

CAMBRIDGE UNIV. (ENGLAND). DEPT. OF APPLIED BIOLOGY.
Effects of Mine Drainage on the River Hayle, Cornwall (A) Factors Affecting Concentrations of Copper, Zinc and Iron in Water, Sediments and Dominant Invertebrate Fauna,
W80-03891 5C

CANADA CENTRE FOR INLAND WATERS, BURLINGTON (ONTARIO).
Distribution of Bacteria and Chlorophyll A at a Nearshore Station in Lake Ontario,
W80-03822 5C

CANTERBURY UNIV., CHRISTCHURCH (NEW ZEALAND). DEPT. OF ZOOLOGY.
Experimental Ecology with Particular Reference to Proposed Commercial Harvesting of Durvillaea (Phaeophyta, Durvilleales) in New Zealand,
W80-03802 2I

CAPE TOWN UNIV. (SOUTH AFRICA). MARINE GEOSCIENCE UNIT.
Langebaan Lagoon: A Mixed Carbonate-Siliciclastic Tidal Environment in a Semi-Arid Climate,
W80-03865 2J

CESKOSLOVENSKA AKADEMIE VED, PRAGUE. HYDROBIOLOGICKA LAB.
Seasonal Changes of Bacterioplankton in a Reservoir Related to Algae. I. Numbers and Biomass,
W80-03811 5C

CESKOSLOVENSKA AKADEMIE VED, TREBON. DEPT. OF HYDROBOTANY.
Photosynthetically Active Radiation in a Stand of Phragmites Communis Trin. II. Model of Light Extinction in the Stand,
W80-03869 2H

CESKOSLOVENSKA AKADEMIE VED, TREBON. INST. OF MICROBIOLOGY.
Semicontinuous Outdoor Cultivation of Scenedesmus Acutus in Waste Water,
W80-03705 5A

CHIAP HUA COMALCO LTD., KOWLOON (HONG KONG).
Flow Visualization in Complex Turbulent Flows,
W80-03715 8B

CITY UNIV. OF NEW YORK. DEPT. OF BIOLOGY.
A Nutritional Analysis of a Sublittoral Diatom Assemblage Epiphytic on Enteromorpha from a Long Island Salt Marsh,
W80-03862 2I

CLEAN-FLO LABS., INC., HOPKINS, MN.
The Use of Multiple Inversion and Clean-Flo Lake Cleanser in Controlling Aquatic Plants,
W80-03828 4A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND CHEMICAL ENGINEERING.
Infiltration of Soils as Affected by the Pressure and Water Content at the Time of Compaction,
W80-03722 2G

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRONOMY.
Measuring Evapotranspiration of Turfgrass,
W80-03646 2D

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF CIVIL ENGINEERING.
Role of Rill Development in Salt Loading from Hillslopes,
W80-03643 2J

The Anticipated Decision Influence Period in Real Time Reservoir Operation,
W80-03645 6A

An Interactive River Basin Water Management Model: Synthesis and Application,
W80-03708 6A

A Hysteresis Model Based on an Explicit Domain-Dependence Function,
W80-03720 2G

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF EARTH RESOURCES.
Hydraulic Conductivity of Mountain Soils,
W80-03775 2C

COMMONWEALTH ASSOCIATES INC., JACKSON, MI.
A Cultural Resource Survey of the Teton Replacement Farmland, Jefferson County, Idaho,
W80-03778 6B

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA). DIV. OF ENVIRONMENTAL MECHANICS.
Measured and Approximate Flux-Concentration Relations for Absorption of Water by Soil,
W80-03721 2G

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CRONULLA (AUSTRALIA). DIV. OF FISHERIES AND OCEANOGRAPHY.
Phytoplankton Distribution and Light Attenuation in Port Hacking Estuary,
W80-03799 5C

The Release of Reactive Phosphate by a Posidonia Australis Seagrass Community,
W80-03808 2A

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, GRIFFITH (AUSTRALIA). DIV. OF IRRIGATION RESEARCH.
Management of Elodea in Australian Irrigation Systems,
W80-03825 4A

Assessment of Aquatic Weed Problems,
W80-03826 4A

Formulating Aquatic Weed Management Programs,
W80-03841 4A

CONNECTICUT DEPT. OF ENVIRONMENTAL PROTECTION, MIDDLEBURY.
Rotenone Resistance of Golden Shiners from a Periodically Reclaimed Pond,
W80-03702 5A

CONNECTICUT UNIV., GROTON. MARINE SCIENCES INST.
Suspended Material Distributions in the Wake of Estuarine Channel Dredging Operations,
W80-03631 2J

COOK COLL., NEW BRUNSWICK, NJ. DEPT. OF ENVIRONMENTAL SCIENCE.
Dissolved Oxygen and Biochemical Oxygen Demand,
W80-03612 5A

CORPS. OF ENGINEERS, WASHINGTON, DC. WASHINGTON DISTRICT.
Water Resource Policies and Authorities: Federal Participation in Shore, Hurricane, Tidal and Lake Flood Protection (Final Rule).
W80-03877 6E

CULP/WESNER/CULP, SANTA ANA, CA.
Estimating Water Treatment Costs, Volume 4. Computer User's Manual for Retrieving and Updating Cost Data,
W80-03655 5F

D.A.V. COLL., MUZAFFARNAGAR (INDIA). DEPT. OF ZOOLOGY.
In Vitro Inhibition of Three Phosphatases by Mercuric Chloride and Their Reversal by Chelating Agent EDTA,
W80-03685 5A

DALHOUSIE UNIV., HALIFAX (NOVA SCOTIA). DEPT. OF OCEANOGRAPHY.
Influence of the Shelf-Break Front off Nova Scotia on Phytoplankton Standing Stock in Winter,
W80-03809 5C

DEBEVOISE AND LIBERMAN, WASHINGTON, DC.
The Federal Reserved Rights Doctrine - from 1866 Through Eagle County,
W80-03777 6E

DELAWARE UNIV., LEWES. COLL. OF MARINE STUDIES.
Rangia Cuneata in An Industrial Water System (Bivalvia: Mactridae),
W80-03669 5A

DELAWARE UNIV., NEWARK. DEPT. OF CIVIL ENGINEERING.
Contributions of Urban Land Use to Stream Water Quality,
W80-03644 5B

DELTA INST. OF HYDROBIOLOGICAL RESEARCH, YERSEKE (NETHERLANDS).
Consumption of Eelgrass, Zostera Marina, by Birds and Invertebrates During the Growing Season in Lake Grevelingen (SW Netherlands),
W80-03819 5C

DEPARTMENT OF AGRICULTURE, WELLINGTON (NEW ZEALAND). WALLACEVILLE ANIMAL RESEARCH CENTER.
Organochlorine, Fluorine, and Heavy-Metal Levels in Some Birds from New Zealand Estuaries,
W80-03691 5B

DEPARTMENT OF THE ENVIRONMENT, VICTORIA (BRITISH COLUMBIA).
British Columbia Aquatic Plant Management Program,
W80-03840 4A

DU PONT DE NEMOURS (E.I.) AND CO., AIKEN, SC. SAVANNAH RIVER LAB.
Aeromonas Distribution and Survival in a Thermally Altered Lake,
W80-03787 4A

DUKE UNIV., DURHAM, NC. DEPT. OF CIVIL ENGINEERING.
Level III: Receiving Water Quality Modeling for Urban Stormwater Management,
W80-03657 5D

EAST TENNESSEE STATE UNIV., JOHNSON CITY.
Public Water Supplies: The Effect of Federal and Tennessee Water Resource Law,
W80-03601 6E

ENVIREX INC., MILWAUKEE, WI. ENVIRONMENTAL SCIENCES DIV.
Screening/Flotation Treatment of Combined Sewer Overflows, Volume II: Full-Scale Operation Racine, Wisconsin,
W80-03652 5D

ENVIRONMENTAL RESEARCH LAB., GULF BREEZE, FL.
An Artificial Microbial Ecosystem for Determining Effects and Fate of Toxicants in a Salt-Marsh Environment,
W80-03670 5A

ENVIRONMENTAL RESEARCH LAB., NARRAGANSETT, RI.
Copper Toxicity to the Bay Scallop (Argopecten Irradians),
W80-03689 5C

ERINDALE COLL., (ONTARIO). DEPT. OF ZOOLOGY.
Body Size and Feeding Ecology as Alternatives to Taxonomy for the Study of Limnetic Zooplankton Community Structure,
W80-03815 5A

EXXON PRODUCTION RESEARCH CO., HOUSTON, TX. (ASSIGNEE).
Method for Removing Suspended Oil Droplets from Water,
W80-03647 5D

FLORIDA STATE GAME AND FRESH WATER FISH COMMISSION, EUSTIS. EUSTIS FISHERIES RESEARCH LAB.
Taxonomic Characteristics of Aquatic Plants from the Alimentary Tract of Grass Carp,
W80-03831 4A

FLORIDA UNIV., GAINESVILLE. DEPT. OF BOTANY; AND FLORIDA UNIV., GAINESVILLE. DEPT. OF AGRONOMY.
Seasonal Variation in the Biomass, Tuber Density, and Photosynthetic Metabolism of Hydrilla in Three Florida Lakes,
W80-03834 5C

FLORIDA UNIV., GAINESVILLE. DEPT. OF ENVIRONMENTAL ENGINEERING SCIENCES.
On the Value of Soil Columns for Assessing the Transport Pattern of Viruses Through Soils: A Critical Outlook,
W80-03622 5B

Comparative Biomass and Growth of Cypress in Florida Wetlands,
W80-03866 2I

FLORIDA UNIV., GAINESVILLE. DEPT. OF GEOLOGY.
Geohydrologic Model of the Floridan Aquifer in the Southwest Florida Water Management District,
W80-03751 2F

GEOLOGICAL SURVEY, ALBUQUERQUE, NM. WATER RESOURCES DIV.
Ground Water in the San Juan Basin, New Mexico and Colorado,
W80-03763 2F

GEOLOGICAL SURVEY, ANCHORAGE, AL. WATER RESOURCES DIV.
Water Resources Data for Alaska, Water Year 1978.
W80-03753 7C

GEOLOGICAL SURVEY, AUSTIN, TX. WATER RESOURCES DIV.
Development of Ground Water in the Houston District, Texas, 1970-74,
W80-03768 4B

GEOLOGICAL SURVEY, BISMARCK, ND. WATER RESOURCES DIV.
Ground-Water Resources of Grant and Sioux Counties, North Dakota,
W80-03767 2F

GEOLOGICAL SURVEY, DORAVILLE, GA.
An Interim Report on the Intensive River-Quality Assessment of the Upper Chattahoochee River Basin, Georgia,
W80-03609 5B

GEOLOGICAL SURVEY, HARTFORD, CT. WATER RESOURCES DIV.
Places in Connecticut Where Ground Water is Known to Have Deteriorated in Quality,
W80-03762 7C

GEOLOGICAL SURVEY, INDIANAPOLIS, IN. WATER RESOURCES DIV.
Water Resources Data for Indiana, Water Year 1978.
W80-03752 7C

GEOLOGICAL SURVEY, LAKEWOOD, CO. WATER RESOURCES DIV.
Hydrologic Data for Wells, Springs, and Streams in Boulder County, Colorado,
W80-03757 2A

GEOLOGICAL SURVEY, LITTLE ROCK, AR. WATER RESOURCES DIV.
Water-Quality Assessment of the L'Anguille River Basin, Arkansas,
W80-03758 5B

GEOLOGICAL SURVEY, MADISON, WI. WATER RESOURCES DIV.
Low-Flow Characteristics of Streams in the Pecatonica-Sugar River Basin, Wisconsin,
W80-03765 2E

GEOLOGICAL SURVEY, NSTL STATION, MS.
Thermal Modeling of Highly Transient Flows in the Chattahoochee River Near Atlanta, Georgia,
W80-03615 2E

GEOLOGICAL SURVEY, PITTSBURGH, PA. WATER RESOURCES DIV.
Selected Water Resources Data, Clarion River and Red-Bank Creek Basins, Northwestern Pennsylvania--Part 2,
W80-03770 7C

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River-Quality Assessment: Concept, Framework, and Application in the Willamette River Basin, Oregon,
W80-03608 6B

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A Technique for Estimating Heights Reached by the 100-Year Flood on Unregulated, Nontidal Streams in North Carolina,
W80-03764 2E

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Residuals Management: A Tool in River-Quality Assessment Applied to Coal Development in the Yampa River Basin, Colorado,
W80-03616 6B

GEOLOGICAL SURVEY, TACOMA, WA. WATER RESOURCES DIV.
Selected Hydrologic Data for Spokane Valley, Spokane, Washington, 1977-78,
W80-03769 2F

GEOLOGICAL SURVEY, TALLAHASSEE, FL. WATER RESOURCES DIV.
Water Resources Data for Florida, Water Year 1978--Volume 3A-1. Southwest Florida Surface Water.
W80-03754 7C

Water Resources Data for Florida, Water Year 1978--Volume 3A-2. Southwest Florida Surface Water Quality.
W80-03755 7C

Water Resources Data for Florida, Water Year 1978--Volume 3B. Southwest Florida Ground Water.
W80-03756 7C

Surface-Water Features in Osceola County and Adjacent Areas, Florida,
W80-03761 7C

Instrumentation of Urban Hydrology Monitoring Sites in Southeast Florida,
W80-03766 7B

Summary of U.S. Geological Survey Investigations and Hydrologic Conditions in the Southwest Florida Water Management District for 1978,
W80-03771 7C

GLASSIE, PEWETT, BEEBE AND SHANKS, WASHINGTON, DC.
Liability for Oil Pollution - United States Law,
W80-03667 6E

GOSUDARSTVENNYI NAUCHNO-ISSLEDOVANII INST. OZERNOGO I RECHNOGO RYBNOGO KHOZYAISTVA, GORKII (USSR). GORKII LAB.
The Effect of the Degree of Mineralization of Water on Phytoplankton,
W80-03664 5A

GOVERNORS STATE UNIV., PARK FOREST SOUTH, IL. COLL. OF ENVIRONMENTAL AND APPLIED SCIENCES.
Trace Element Loading of Southern Lake Michigan by Dry Deposition of Atmospheric Aerosol,
W80-03621 5B

HAMBURG UNIV. (GERMANY, F.R.). INST. FUER HYDROBIOLOGIE UND FISCHEREI-WISSENSCHAFT.
Investigations on the Effects of Domestic Sewage on the Benthic Ecosystem of Marine Intertidal Flats (In German),
W80-03684 5C

HAMPSHIRE COLL., AMHERST, MA. DEPT. OF POLITICAL SCIENCE.
Environmental Protection for Whom,
W80-03853 6B

HARBOR BRANCH FOUNDATION, INC., FORT PIERCE, FL.
Seasonal Occurrence and Variation in Standing Crop of a Drift Algal Community in the Indian River, Florida,
W80-03803 5C

HARVARD UNIV., CAMBRIDGE. DIV. OF APPLIED SCIENCES.
Standards, Optimality and Resilience in Water-Resource Management,
W80-03750 6A

HAWAII UNIV., HONOLULU. COLL. OF TROPICAL AGRICULTURE.
Multinational Corporations, Nation-States and Ocean Resource Management: The Impact of the World's 200-Mile Economic Zone on Multinational and National Development,
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Phytosociological Studies of Uryu-Numa Mire Studies of Upland Bog Vegetation in Hokkaido (II), (In Japanese),
W80-03874 2I

HOLKAR SCIENCE COLL., INDORE (INDIA). DEPT. OF ZOOLOGY.
Studies on the Effects of Acidic Medium on the Fry of Cyprinus Carpio,
W80-03706 5A

HOWARD, NEEDLES, TAMMEN, AND BERGENDOFF. INDIANAPOLIS, IN.
Combined Sewer Overflow Treatment by Screening and Terminal Ponding -- Fort Wayne, Indiana,
W80-03656 5D

HUMPHREYS (HOWARD) AND PARTNERS, READING (ENGLAND).
Preparation of Friable Aquiferous Specimens,
W80-03719 8E

IDAHO UNIV., MOSCOW. DEPT. OF BIOLOGICAL SCIENCES.
Stream Types in Idaho: An Approach to Classification of Streams in Natural Areas,
W80-03835 6B

ILLINOIS STATE WATER SURVEY, URBANA.
Hydraulics of Flow in the Kaskaskia River, Illinois,
W80-03713 2E

ILLINOIS UNIV. AT URBANA-CHAMPAIGN. DEPT. OF ECOLOGY, ETHOLOGY, AND EVOLUTION.
Determinants of Water Quality in Agricultural Watersheds,
W80-03709 5G

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A Review of the Lethal and Sub-Lethal Effects of Mercury on Aquatic Life,
W80-03683 5A

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Mercury Circulation in Aquatic Environment. Part 2: Metabolism of Methyl and Phenyl Mercury in Phytoplankton,
W80-03682 5B

INSTITUTE OF BIOLOGY OF THE SOUTHERN SEAS, SEVASTOPOL (USSR).
Effect of Some Chemical Agents on the Uptake of 32p and 65Zn by Macrophytes in the Black Sea,
W80-03662 5B

Extraction and Accumulation of 210Pb by Aquatic Organisms in Lakes,
W80-03677 5B

INSTITUTE OF EXPERIMENTAL METEOROLOGY OBRINSK (USSR).
Quantitative Extraction of Chlorinated Organic Pesticides and Polychlorinated Biphenyls from Fish Organs and Tissues,
W80-03674 5A

INSTITUTE OF LIMNOLOGY, NIEUWERSLUIS (NETHERLANDS).
Effect of Benzoate on Microbial Decomposition of Fulvic Acids in Tjeukemeer (The Netherlands),
W80-03893 2K

INSTITUTE OF OCEAN SCIENCES, SIDNEY (BRITISH COLUMBIA).
Submarine Slide-Generated Water Waves in Kitimat Inlet, British Columbia,
W80-03627 2L

INSTITUTE OF OCEANOGRAPHIC SCIENCES, WORMLEY (ENGLAND).
The Effects of Vertical Stability on Phytoplankton Distributions in the Summer on the Northwest European Shelf,
W80-03784 5C

INSTITUTE OF TERRESTIAL ECOLOGY, EDINBURGH (SCOTLAND). PLANKTON ECOLOGY PROJECT GROUP.
A Nine-Year Study of the Phytoplankton of the Eutrophic and Non-Stratifying Loch Leven (Kinross, Scotland),
W80-03816 5C

INSTITUTO INVESTIGACIONES PESQUERAS, BARCELONA (SPAIN).
Two Phases of the Phytoplankton Community in the Baja California Upwelling,
W80-03805 5C

IOWA STATE UNIV., AMES.
Phytomechanics--Plant Physiology and Applied Mechanics,
W80-03780 2I

JOHNSON (WALLACE E.) CO., TOPSFIELD, MA.
Design of an Indirect Freezing Process Pilot Plant Based on Bulk Crystallization,
W80-03772 3A

KALYANI UNIV., WEST BENGAL, (INDIA). DEPT. OF ZOOLOGY.
Pesticides and Aquatic Ecosystems,
W80-03699 5C

KARACHI UNIV. (PAKISTAN). INST. OF MARINE BIOLOGY.
Species Composition and Seasonal Occurence of Centric Diatoms in a Polluted Marine Environment,
W80-03820 5C

KASPIISKII NAUCHNO-ISSLEDOVATELSKII INST. RYBNOGO KHOZYAISTVA, ASTRAKHAN (USSR).
Variation in the Reactions of Daphnia Magna Straus to the Effect of a Toxicant as Related to Its Delivery Regime,
W80-03676 5A

KHARTOUM UNIV. (SUDAN). DEPT. OF CIVIL ENGINEERING.
Air Bubbles in a Convectively Accelerated Water Flow,
W80-03740 8B

LOUISIANA DEPT. OF WILDLIFE AND FISHERIES, BATON ROUGE.
Establishment of Waterhyacinth Weevil Populations in Louisiana,
W80-03829 4A

Effects of Mechanical Cutting on Submersed Vegetation in a Louisiana Lake,
W80-03832 4A

LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.
Holocene Sedimentation at Cape Sable, South Florida,
W80-03864 2J

LUND UNIV. (SWEDEN). DEPT. OF MICROBIAL ECOLOGY.
Effects of Artificial Acid Rain on Microbial Activity and Biomass,
W80-03688 5C

MACDONALD (SIR M.) AND PARTNERS, CAMBRIDGE (ENGLAND).
Measurements of Combined Oscillatory and Steady Flow Over a Rough Bed,
W80-03620 8B

MAINE UNIV. AT FARMINGTON. CENTER FRO ENVIRONMENTAL RESEARCH AND EDUCATION.
Phosphrus Export from Rural Maine Watersheds,
W80-03776 5B

MAINE UNIV. AT ORONO. DEPT. OF MATHEMATICS.
Damping of Gravity Waves over Porous Bed,
W80-03716 8B

MALAYA UNIV., KUALA LUMPAR (MALAYSIA). SCHOOL OF BIOLOGICAL SCIENCES.
Distribution of Macrofauna on a Malayan Mangrove Shore,
W80-03870 2I

MANNHEIM UNIV. (GERMANY, F.R.).
Environmental Management in General Equilibrium: A New Incentive Compatible Approach,
W80-03855 6B

MARYLAND UNIV., COLLEGE PARK. DEPT. OF ENTOMOLOGY.
Behavior of Abate in Microorganisms Isolated from Polluted Water,
W80-03892 5F

MARYLAND UNIV., COLLEGE PARK. DEPT. OF MICROBIOLOGY.
Microbial Impact of Canada Geese (Branta Canadensis) and Whistling Swans (Cygnus Columbianus Columbianus) on Aquatic Ecosystems,
W80-03794 5B

MARYLAND UNIV., SOLOMONS. CHESAPEAKE BIOLOGICAL LAB.
Carnivorous Feeding Behavior of the Adult Calanoid Copepod Acartia Tonsa Dana,
W80-03783 5C

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. DEPT. OF EARTH AND PLANETARY SCIENCES.
Observations of Stratified Flow Past Three-Dimensional Barriers,
W80-03624 8B

MASSACHUSETTS UNIV., AMHERST. DEPT. OF BOTANY.
Mutagenicity of Fluorene Derivatives: A Proposed Mechanism,
W80-03745 5A

Mutagens in a River Heavily Polluted with Paper Recycling Wastes: Results of Field and Laboratory Mutagen Assays,
W80-03746 5A

MASSACHUSETTS UNIV., AMHERST. WATER RESOURCES RESEARCH CENTER.
The Potential for Municipal Wastewater Reuse by Industry in Massachusetts,
W80-03747 3C

MC GLEW AND BROWN, AUSTIN, TX.
Legal and Institutional Factors Affecting Mariculture in Texas,
W80-03873 6E

MCGILL UNIV., MONTREAL, (QUEBEC). DEPT. OF BIOLOGY.
The Microdistribution of Epiphytes on the Leaves of Natural and Artificial Macrophytes,
W80-03798 5C

Factors Affecting Tissue Nutrient Concentrations in a Scirpus-Equisetum Wetland,
W80-03876 2I

MCMASTER UNIV., HAMILTON (ONTARIO). DEPT. OF CIVIL ENGINEERING AND ENGINEERING MECHANICS.
A Generalized Approach to Kinematic Flood Routing,
W80-03732 2E

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Forecasting Storm Rainfall Over Bhagirathi Catchment Due to Depressions/Cyclonic Storms,
W80-03635 2B

METEOROLOGICAL OFFICE, POONA (INDIA).
On the Assessment of Crop Droughts: A Case Study for Disa (Gujarat),
W80-03637 2B

Does Precipitation Pattern Foretell Gujarat Climate Becoming Arid,
W80-03638 2B

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Early Growth of Picea Sitchensis (Bong.) Carr on Deep Oligotrophic Peat in Northern Ireland,
W80-03863 2I

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The Field Assessment of Effects of Dumping Wastes at Sea: 3. A Survey of the Sewage Sludge Disposal Area in Lyme Bay,
W80-03696 5A

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The Relationship Between Vertebral Number and Water Temperature in Cod,
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Hydraulics of a Large Channel Paved with Boulders,
W80-03741 2E

MINNESOTA UNIV., MINNEAPOLIS. DEPT. OF ECOLOGY AND BEHAVIORAL BIOLOGY.
Attenuation of Light and Daily Integral Rates of Photosynthesis Attained by Planktonic Algae,
W80-03837 2H

MISSISSIPPI STATE UNIV., MISSISSIPPI STATE. DEPT. OF BIOLOGICAL SCIENCES.
Taxonomic Notes on Epiphytic Diatoms of Mississippi Sound, U.S.A.,
W80-03781 5C

MOBIL OIL CORP., NEW YORK.
Environmental Quality and Economic Development,
W80-03857 6E

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Structural Controls of Hot-Spring Systems in Southwestern Montana,
W80-03760 1A

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Ocean Tide Effect Study on a Coastal Carbonate Aquifer (Miocene of Algarve, Portugal) ((Etude De L'Effet De Maree Oceanique Sur Un Aquifere Carbonate Cotier (Miocene De L'Algarve--Portugal)),
W80-03731 2F

MOSCOW STATE UNIV., (USSR).
Very Simple Model of the Initial Stage of Oligotrophic-Eutrophic Succession. In Bodies of Water,
W80-03792 5A

MOSS LANDING MARINE LAB., CA.
Light Stimulation of Phosphate Uptake in Natural Assemblages of Phytoplankton,
W80-03821 5C

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Comparison of Ozone Contactors for Municipal Wastewater Effluent Disinfection -- Packed Column Versus Jet Scrubber,
W80-03653 5D

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Effects of Dams and Impoundments on Migrations of Juvenile Chinook Salmon and Steelhead from the Snake River, 1966 to 1975,
W80-03701 5A

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, ANN ARBOR, MI. GREAT LAKES ENVIRONMENTAL RESEARCH LAB.
Two Electivity Indices for Feeding with Special Reference to Zooplankton Grazing,
W80-03810 5C

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Chemotherapeutical Studies on Trimethoprim Against Vibriosis of Pond-Cultured Ayu--II. Tissue Levels After Administration of Trimethoprim-Sulfadoxine Mixture (In Japanese),
W80-03693 5B

NATIONAL SWEDISH PROTECTION BOARD, UPPSALA.
An Empirical Model for Physical Parameters of Recent Sedimentary Deposits of Lake Ekoln and Lake Vanern,
W80-03790 5A

NEDERLANDS INST. VOOR ONDERZOEK DER ZEE, TEXEL.
Behaviour of Manganese in the Rhine and Scheldt Estuaries, II. Geochemical Cycling,
W80-03630 2L

Mobilization of Organochlorines from Female Lipid Tissue and Transplacental Transfer to Fetus in a Harbour Porpoise (Phocoena Phocoena) in a Contaminated Area,
W80-03687 5B

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Paul Spring: An Investigation of Recharge in the Roswell (NM) Artesian Basin,
W80-03642 2F

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF BIOLOGY.
Enterovirus Inactivation in Soil and Structural Changes Associated with the Inactivation of Soil-Bound Viruses,
W80-03603 3C

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF ECONOMICS AND BUSINESS.
Guidelines for Socioeconomic Impact Analyses of Environmental Regulations,
W80-03602 6C

O'BRIEN AND GERE ENGINEERS, INC., SYRACUSE, NY.
Disinfection/Treatment of Combined Sewer Overflows, Syracuse, New York,
W80-03651 5D

OHIO STATE UNIV., COLUMBUS. DEPT. OF CIVIL ENGINEERING.
Formulating Lake Models Which Preserve Spectral Statistics,
W80-03605 2H

Effect of Particulates on Ozone Disinfection of Bacteria and Viruses in Water,
W80-03654 5F

Verifying Lake Transport Models with Special Statistics,
W80-03836 2H

OKAYAMA UNIV. (JAPAN). DEPT. OF PUBLIC HYGIENE.
Identification of Organic Sulfur Compounds Transferred to Fish from Petroleum Suspension by Mass Chromatography,
W80-03671 5B

OLD DOMINION UNIV., NORFOLK, VA. INST. OF OCEANOGRAPHY.
Effects of Dinoflagellate Bioluminescence on the Ingestion Rates of Herbivorous Zooplankton,
W80-03782 5C

ONTARIO MINISTRY OF AGRICULTURE AND FOOD, GUELPH. PESTICIDE RESIDUE LAB.
Organochlorine Insecticides and PCBs in Sediments of Lake St. Clair (1970 and 1974) and Lake Erie (1971),
W80-03894 5C

ONTARIO MINISTRY OF THE ENVIRONMENT, OTTAWA.
Characteristics of Effluents from Gray and Black Water Septic Tanks,
W80-03791 5B

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Incidents of Elevated Nitrate in Southern Ontario,
W80-03623 5B

OREGON STATE UNIV., CORVALLIS. SCHOOL OF OCEANOGRAPHY.
Effects of Temperature and Salinity on Production and Hatching of Dormant Eggs of Acartia Californiensis (Copepoda) in an Oregon Estuary,
W80-03700 5A

OTAGO UNIV., DUNEDIN (NEW ZEALAND). DEPT. OF BOTANY.
A Lowland Vegetation Sequence in South Westland: Pakihi Bog to Mixed Beech-Podocarp Forest. Part 1: The Principal Strata,
W80-03867 2I

OTTAWA UNIV. (ONTARIO). DEPT. OF GEOGRAPHY AND REGIONAL PLANNING.
Spatial Aspects of the Pressure for Shoreline Development: The Example of Puget Sound,
W80-03884 6E

PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION, COLLEGE, AK. INST. OF NORTHERN FORESTRY.
Hydrologic Role of Shallow Organic Soils in Cold Climates,
W80-03649 2G

PHYSICAL RESEARCH LAB., AHMEDABAD (INDIA).
Comparative Study of Groundwater Recharge Rates in Parts of Indo-Gangetic and Sabarmati Alluvial Plains,
W80-03636 2F

PLYMOUTH POLYTECHNIC (ENGLAND) SCHOOL OF ENVIRONMENTAL SCIENCES.
The Effects of the Anaesthetic Quinaldine on Oxygen Consumption in an Intertidal Teleost Blennius Pholis (L.),
W80-03690 5A

PORTLAND STATE UNIV., OR. DEPT. OF BIOLOGY.
Algal Growth Potential--Lower Willamette River, Oregon,
W80-03614 5B

PUERTO RICO DEPT. OF NATURAL RESOURCES, SAN JUAN.
Structure of Mangrove Forests in Florida, Puerto Rico, Mexico, and Costa Rica,
W80-03879 2I

PUERTO RICO UNIV., MAYAGUEZ. DEPT. OF MARINE SCIENCES.
The Distribution of Algal Epiphytes on Macrophyte Hosts Offshore from La Parguera, Puerto Rico,
W80-03797 5C

PUNJAB AGRICULTURAL UNIV., LUDHIANA (INDIA). DEPT. OF SOILS.
Influence of a Compact Zone on Solute Transport During Infiitration of Water,
W80-03727 2G

QUEBEC UNIV., RIMOUSKI. DEPT. OF OCEANOGRAPHY.
Hydrochemistry of Dissolved Inorganic Carbon in the St. Lawrence Estuary (Canada),
W80-03736 2L

QUEEN'S UNIV., KINGSTON (ONTARIO). DEPT. OF BIOLOGY.
Optimal Niche Space of the Redwinged Blackbird (Agelaius Phoeniceus), I. Nesting Success in Marsh and Upland Habitat,
W80-03875 2I

QUEENSLAND DEPT. OF LANDS, BRISBANE (AUSTRALIA).
A New Approach for Salvinia Control,
W80-03827 4A

QUEENSLAND UNIV., BRISBANE (AUSTRALIA). DEPT. OF BOTANY.
Pattern and Diversity in Swamp and Dune Vegetation, North Stradbroke Island,
W80-03882 2I

RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, NC.
Some Aspects of the Oceanography of the Gulf of Mexico Using Satellite and in Situ Data,
W80-03628 2L

RHODE ISLAND UNIV., KINGSTON.
Manganese Removal from Water by Flotation with Microgas Dispersions,
W80-03748 5F

Fishermen's Remuneration Systems and Implications for Fisheries Development,
W80-03858 6C

RHODE ISLAND UNIV., KINGSTON. GRADUATE SCHOOL OF OCEANOGRAPHY.
Incorporation, Distribution and Fate of Saturated Petroleum Hydrocarbons in Sediments from a Controlled Marine Ecosystem,
W80-03899 5C

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF ENTOMOLOGY AND ECONOMIC ZOOLOGY.
Comparison of the Assemblages of Sap-Feeding Insects (Homoptera-Hemiptera) Inhabiting Two Structurally Different Salt Marsh Grasses in the Genus Spartina,
W80-03881 2I

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. DEPT. OF HUMAN ECOLOGY AND SOCIAL SCIENCES.
Systems Ecology, People Ecology, and the Anthropology of Fishing Communities,
W80-03860 6B

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. WATER RESOURCES RESEARCH INST.
Erosional Aspects of Managing Urban Streams,
W80-03773 2J

RUTGERS - THE STATE UNIV., NEW BURNSWICK, N.J. DEPT. OF ENVIRONMENTAL SCIENCE.
The Influence of Urbanization of the Transport of Heavy Metals in New Jersey Streams,
W80-03774 5B

SASKATCHEWAN DEPT. OF THE ENVIRONMENT, REGINA.
A Periphyton Growth Substrate Useful for Nutrient Impact Studies in Large Rivers,
W80-03665 5A

SCIENCE AND EDUCATION ADMINISTRATION, AMES, IA.
Soil and Water Losses from Corn-Soybean Rotations,
W80-03725 2J

SCIENCE AND EDUCATION ADMINISTRATION, RIVERSIDE, CA. SALINITY LAB.
A Rainfall Simulator with Nonrepetitious Movement of Drop Outlets,
W80-03726 2B

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CA.
A Reexamination of Bagnold's Granular-Fluid Model and Bed Load Transport Equation,
W80-03625 2J

Nitrate and Phytoplankton Production in Southern California Coastal Waters,
W80-03789 5C

SNYDER OCEANOGRAPHY SERVICES, INC., JUPITER, FL.
Tidal Hydraulics in Estuarine Channels,
W80-03714 2L

SRI LANKA UNIV., PERADENIYA. DEPT. OF BOTANY.
The Ecology of a Saltmarsh in Sri Lanka,
W80-03871 2I

STATE UNIV. OF NEW YORK AT STONY BROOK. MARINE SCIENCES RESEARCH CENTER.
Recent Geochemical History of Flood Deposits in the Northern Chesapeake Bay,
W80-03735 2J

STOCKHOLM UNIV. (SWEDEN).
Estimating Willingness to Pay: Why and How.,
W80-03846 6B

TECHNICAL UNIV. OF ISTANBUL (TURKEY). DEPT. OF HYDROLOGY AND WATER POWER.
Statistical Analysis of Hydrologic Critical Droughts,
W80-03618 2E

TECHNION-ISRAEL INST. OF TECH., HAIFA. FACULTY OF AGRICULTURAL ENGINEERING.
An Evaluation of Marginal Waters as a Natural Resource in Israel,
W80-03742 3C

TECHNION-ISRAEL INST. OF TECH., HAIFA (ISRAEL). DEPT. OF FOOD ENGINEERING AND BIOTECHNOLOGY.
Algae Grown on Wastewater as a Source of Protein for Young Chickens and Rats,
W80-03817 3C

Secondary Toxicology and Contaminants of Algae Grown on Wastewater,
W80-03818 3C

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF WILDLIFE AND FISHERIES SCIENCES.
A Bioeconomic Model of the Gulf of Mexico Shrimp Fishery,
W80-03845 8I

TEXAS UNIV. AT AUSTIN. BUREAU OF ECONOMIC GEOLOGY.
Interpretation of Unenhanced Landsat Imagery for Wetland and Land Use Delineation in the Texas Coastal Zone,
W80-03878 7C

TEXAS UNIV. AT AUSTIN. DEPT. OF CIVIL ENGINEERING.
Optimization of Unit Hydrograph Determination,
W80-03617 2E

Staged Multiport Diffusers,
W80-03717 5B

TEXAS UNIVERSITY AT DALLAS, RICHARDSON. CENTER FOR ENVIRONMENTAL STUDIES.
Sterols in Natural Water and Sediment,
W80-03900 5C

TRONDHEIM UNIV., (NORWAY). INST. OF MARINE BIOCHEMISTRY.
Application of in Situ Cage Cultures of Phytoplankton for Monitoring Heavy Metal Pollution in Two Norwegian Fjords,
W80-03800 5C

TRONDHEIM UNIV. (SWEDEN). DEPT. OF BOTANY.
Age, Origin, and Palaeo-Ecological Evidence of Blanket Bogs in Nord-Trondelag, Norway,
W80-03868 2J

TSUKUBA UNIV., SAKURAMURA IBARAKI (JAPAN). INST. OF BIOLOGICAL SCIENCES.
Impact of Nutrient Enrichment in a Waterchestnut Ecosystem at Takahama-Iri Bay of Lake Kasumigaura, Japan, II Role of Waterchestnut in Primary Productivity and Nutrient Uptake,
W80-03681 5B

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Fish Mortality and Fishing During an Unprecedented Draught in Lake Pichhola, Udaipur,
W80-03698 2H

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Comparison of Various Methods for Estimating the Quality of Water Based on Bottom-Dwelling Indicator Invertebrates,
W80-03673 5A

UNION CARBIDE CORP., NY. (ASSIGNEE).
Nitrification-Denitrification of Wastewater,
W80-03610 5D

UNIVERSIDAD SIMON BOLIVAR, CARACAS (VENEZUELA).
The Geomorphologic Structure of Hydrologic Response,
W80-03743 2A

UNIVERSITY COLL. OF NORTH WALES, MENAI BRIDGE. MARINE SCIENCE LABS.
The Ecology of Sandy Beaches in Penang, Malaysia, with Special Reference to Excirolana Orientalis (Dana),
W80-03633 2L

The Sublittoral Ecology of the Menai Strait, I. Temporal and Spatial Variation in the Fauna and Flora Along a Transect,
W80-03634 2L

The Islay Front: Physical Structure and Phytoplankton Distribution,
W80-03733 2L

UNIVERSITY COLL. OF SWANSEA (WALES). DEPT. OF GEOLOGY AND OCEANOGRAPHY.
The Design and Use of an Oscillating Trolley Wave-Simulator, for Installation in Unidirectional Flow Flumes,
W80-03737 2L

UNIVERSITY OF CENTRAL FLORIDA, ORLANDO. DEPT. OF BIOLOGICAL SCIENCES.
Biological Control of Hydrilla Verticillata Royle with Grass Carp (Ctenopharyngodon Idella Val),
W80-03830 4A

UNIVERSITY OF EAST ANGLIA, NORWICH (ENGLAND). SCHOOL OF DEVELOPMENTAL STUDIES.
The Analysis of Risk in Irrigation Projects in Developing Countries,
W80-03851 6B

UNIVERSITY OF SOUTH FLORIDA, TAMPA. DEPT. OF BIOLOGY.
The Effects of Oyster Shell Dredging on an Estuarine Benthic Community,
W80-03734 2L

Chemical Fluctuations Due to Seasonal and Cropping Effects on an Algal-Seagrass Community,
W80-03785 2I

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES. DEPT. OF ECONOMICS.
Adaptive Economics and Natural Resources Policy,
W80-03854 6B

UNIVERSITY OF THE WITWATERSTRAND, JOHANNESBURG (SOUTH AFRICA).
Zooplankton in a Quasi-Stable Phase in an Endorheic Lake (Lake Chilwa, Malawi),
W80-03807 5C

UNIVERSITY OF WALES INST. OF SCIENCE AND TECHNOLOGY, CARDIFF. DEPT. OF APPLIED BIOLOGY.
The Distribution and Ecology of the Naididae (Oligochaeta) Which Inhabit the Filter-Beds of Sewage-Works in Britain,
W80-03666 5C

UOP, INC., SAN DIEGO, CA. FLUID SYSTEMS DIV.
Low Pressure Brackish Water Reverse Osmosis Membrane Development - Final Report,
W80-03749 3A

URS CO., SEATTLE, WA.
Toward a Conceptual Framework for River-Quality Trend and Cause-Effect Analysis,
W80-03611 5B

VICTORIA UNIV. OF MANCHESTER (ENGLAND). SIMON ENGINEERING LABS.
On the Calculation of the Width Averaged Flow Due to Long Waves in an Open Channel,
W80-03619 2E

VOLCANI INST. OF AGRICULTURAL RESEARCH, BET-DAGAN (ISRAEL). INST. OF SOIL AND WATER.
Kinetics of Chemical Processes in a Carbonate Aquifer: A Case Study of Water-Rock Interaction in the Aquifer of Western and Central Galilee (Israel),
W80-03730 2K

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF GEOLOGY.
Hydrology of Small Oceanic Islands--Utility of an Estimate of Recharge Inferred from the Chloride Concentration of the Freshwater Lenses,
W80-03729 2F

WASHINGTON UNIV., SEATTLE. DEPT. OF OCEANOGRAPHY.
Turbulence Measurements in the Boundary Layer Over a Sand Wave Field,
W80-03626 2E

WATER AND POWER RESOURCES SERVICE, SACRAMENTO, CA. MID-PACIFIC REGION.
Owner Eligibility Restrictions - Acreage and Residency,
W80-03883 6E

WATER POLLUTION RESEARCH LAB., STEVENAGE (ENGLAND).
The Effect of Phosphate and Temperature on Growth of Activated Sludge and on Biodegradation of Surfactants,
W80-03793 5D

WATERLOO UNIV. (ONTARIO). DEPT. OF BIOLOGY.
Dynamics and Behavioral Toxicology of Aqua-Kleen (Trade Name) (2,4-D Butoxyethanol Ester) as Revealed by the Modification of Rheotropism in Rainbow Trout,
W80-03703 5A

WATERLOOPKUNDIG LAB., DELFT (NETHERLANDS).
On the Magnitude of Interfacial Shear of Subcritical Stratified Flows in Relation with Interfacial Stability,
W80-03738 2E

WEIZMANN INST. OF SCIENCE, REHOVOT (ISRAEL).
Mixing Models and Ionic Geothermometers Applied to Warm (Up to 60C) Springs: Jordan Rift Valley, Israel,
W80-03728 2K

WESTON, HURD, FALLON, PAISLEY, AND HOWLEY, CLEVELAND, OH.
Will Judicial Error Allow Industrial Point Sources to Avoid BPT and Perhaps BAT Later. A Story of Good Intentions, Bad Dictum, and Ugly Consequences,
W80-03885 6E

WILLIAMS COLL., WILLIAMSTOWN, MA. DEPT. OF GEOLOGY.
Surf Zone Dynamics During Upwelling on the Oregon Coast,
W80-03632 2L

WISCONSIN-UNIV., MADISON. DEPT. OF BACTERIOLOGY.
Anerobic Metabolism of Immediate Methane Precursors in Lake Mendota,
W80-03812 5C

Microbial Methanogenesis and Acetate Metabolism in a Meromictic Lake,
W80-03813 2H

WISCONSIN UNIV.-MADISON. DEPT. OF SOIL SCIENCE.
Prediction of the Quality of Water in a Proposed Impoundment in Southwestern Wisconsin, USA,
W80-03801 5B

WISCONSIN UNIV.-MADISON. WATER CHEMISTRY PROGRAM.
The Influence of Adsorption on the Rates of Microbial Degradation of Arsenic Species in Sediments,
W80-03692 5B

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.
Temperature Effects on Steady-State Growth, Phosphorus Uptake, and the Chemical Composition of a Marine Phytoplankter,
W80-03804 5C

YALE UNIV., NEW HAVEN, CT. DEPT. OF GEOLOGY AND GEOPHYSICS.
Particle Reworking in Sediments from the New York Bight Apex: Evidence from 234Th/238U Disequilibrium,
W80-03629 2J

YORK UNIV., DOWNSVIEW (ONTARIO).
Pigovian Taxes, Polluter Subsidies, Regulation, and the Size of a Polluting Industry,
W80-03848 6E

V
1
3
/
J
1
J
E
1
8
0
MI

ACCESSION NUMBER INDEX

W80-03601 6E
W80-03602 6C
W80-03603 3C
W80-03604 3F
W80-03605 2H
W80-03606 5B
W80-03607 5G
W80-03608 6B
W80-03609 5B
W80-03610 5D
W80-03611 5B
W80-03612 5A
W80-03613 7C
W80-03614 5B
W80-03615 2E
W80-03616 6B
W80-03617 2E
W80-03618 2E
W80-03619 2E
W80-03620 8B
W80-03621 5B
W80-03622 5B
W80-03623 5B
W80-03624 8B
W80-03625 2J
W80-03626 2E
W80-03627 2L
W80-03628 2L
W80-03629 2J
W80-03630 2L
W80-03631 2J
W80-03632 2L
W80-03633 2L
W80-03634 2L
W80-03635 2B
W80-03636 2F
W80-03637 2B
W80-03638 2B
W80-03639 1A
W80-03640 3D
W80-03641 4B
W80-03642 2F
W80-03643 2J
W80-03644 5B
W80-03645 6A
W80-03646 2D
W80-03647 5D
W80-03648 2G
W80-03649 2G
W80-03650 2G
W80-03651 5D
W80-03652 5D
W80-03653 5D
W80-03654 5F
W80-03655 5F
W80-03656 5D
W80-03657 5D
W80-03658 2I
W80-03659 5C
W80-03660 5C
W80-03661 5C
W80-03662 5B
W80-03663 5B
W80-03664 5A
W80-03665 5A
W80-03666 5C
W80-03667 6E
W80-03668 6E
W80-03669 5A
W80-03670 5A
W80-03671 5B
W80-03672 5C
W80-03673 5A
W80-03674 5A
W80-03675 5A
W80-03676 5A
W80-03677 5B
W80-03678 5C
W80-03679 5C
W80-03680 5A
W80-03681 5B
W80-03682 5B
W80-03683 5A
W80-03684 5C
W80-03685 5A
W80-03686 5B
W80-03687 5B
W80-03688 5C
W80-03689 5C
W80-03690 5A
W80-03691 5B
W80-03692 5B
W80-03693 5B
W80-03694 5C
W80-03695 6E
W80-03696 5A
W80-03697 5C
W80-03698 2H
W80-03699 5C
W80-03700 5A
W80-03701 5A
W80-03702 5A
W80-03703 5A
W80-03704 5A
W80-03705 5A
W80-03706 5A
W80-03707 6E
W80-03708 6A
W80-03709 5G
W80-03710 6A
W80-03711 2A
W80-03712 2K
W80-03713 2E
W80-03714 2L
W80-03715 8B
W80-03716 8B
W80-03717 5B
W80-03718 2J
W80-03719 8E
W80-03720 2G
W80-03721 2G
W80-03722 2G
W80-03723 2G
W80-03724 2G
W80-03725 2J
W80-03726 2B
W80-03727 2G
W80-03728 2K
W80-03729 2F
W80-03730 2K
W80-03731 2F
W80-03732 2E
W80-03733 2L
W80-03734 2L
W80-03735 2J
W80-03736 2L
W80-03737 2L
W80-03738 2E
W80-03739 2E
W80-03740 8B
W80-03741 2E
W80-03742 3C
W80-03743 2A
W80-03744 7C
W80-03745 5A
W80-03746 5A
W80-03747 3C
W80-03748 5F
W80-03749 3A
W80-03750 6A
W80-03751 2F
W80-03752 7C
W80-03753 7C
W80-03754 7C
W80-03755 7C
W80-03756 7C
W80-03757 2A
W80-03758 5B
W80-03759 6E
W80-03760 1A
W80-03761 7C
W80-03762 7C
W80-03763 2F
W80-03764 2E
W80-03765 2E
W80-03766 7B
W80-03767 2F
W80-03768 4B
W80-03769 2F
W80-03770 7C
W80-03771 7C
W80-03772 3A
W80-03773 2J
W80-03774 5B
W80-03775 2C
W80-03776 5B
W80-03777 6E
W80-03778 6B
W80-03779 3B
W80-03780 2I
W80-03781 5C
W80-03782 5C
W80-03783 5C
W80-03784 5C
W80-03785 2I
W80-03786 2I
W80-03787 4A
W80-03788 5B
W80-03789 5C
W80-03790 5A
W80-03791 5B
W80-03792 5A
W80-03793 5D
W80-03794 5B
W80-03795 6E
W80-03796 5F
W80-03797 5C
W80-03798 5C
W80-03799 5C
W80-03800 5C
W80-03801 5B
W80-03802 2I
W80-03803 5C
W80-03804 5C
W80-03805 5C
W80-03806 5C
W80-03807 5C
W80-03808 2A
W80-03809 5C
W80-03810 5C
W80-03811 5C
W80-03812 5C
W80-03813 2H
W80-03814 6E
W80-03815 5A
W80-03816 5C
W80-03817 3C
W80-03818 3C
W80-03819 5C
W80-03820 5C
W80-03821 5C
W80-03822 5C
W80-03823 6E
W80-03824 5C
W80-03825 4A
W80-03826 4A
W80-03827 4A
W80-03828 4A
W80-03829 4A
W80-03830 4A
W80-03831 4A
W80-03832 4A
W80-03833 4A
W80-03834 5C
W80-03835 6B
W80-03836 2H
W80-03837 2H
W80-03838 5B
W80-03839 2E
W80-03840 4A
W80-03841 4A
W80-03842 3A
W80-03843 6D
W80-03844 6B
W80-03845 8I
W80-03846 6B
W80-03847 6B
W80-03848 6E
W80-03849 6B
W80-03850 6B
W80-03851 6B
W80-03852 6E
W80-03853 6B
W80-03854 6B
W80-03855 6B
W80-03856 6F
W80-03857 6E
W80-03858 6C
W80-03859 6E
W80-03860 6B
W80-03861 2L
W80-03862 2I
W80-03863 2I
W80-03864 2J
W80-03865 2J
W80-03866 2I
W80-03867 2I
W80-03868 2J
W80-03869 2H
W80-03870 2I
W80-03871 2I
W80-03872 2H
W80-03873 6E
W80-03874 2I
W80-03875 2I
W80-03876 2I
W80-03877 6E
W80-03878 7C
W80-03879 2I
W80-03880 6E
W80-03881 2I
W80-03882 2I
W80-03883 6E
W80-03884 6E
W80-03885 6E
W80-03886 6E
W80-03887 6E
W80-03888 3F
W80-03889 6E
W80-03890 5C
W80-03891 5C
W80-03892 5F
W80-03893 2K
W80-03894 5C
W80-03895 5C
W80-03896 5C
W80-03897 5C
W80-03898 5C
W80-03899 5C
W80-03900 5C

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Illinois State Water Survey, Hydrology	W80-03605--03609 03611--03638 03713--03744 03836--03837 03839	68
University of Florida, Eastern U. S. Water Law	W80-03667--03668 03695, 03759 03777, 03795 03814, 03823 03873, 03877 03880 03883--03889	18
University of Wisconsin, Eutrophication	W80-03782--03794 03796--03813 03815--03822 03824--03834 03890--03894 03900	56
University of Wisconsin, Water Resources Economics	W80-03840--03860	21
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W80-03601--03603 03640--03646 03658--03660 03707--03712 03745--03748 03751 03773--03775 03780--03781 03838	30
C. OTHER		
Environmental Information Services, Inc. (Effects of Pollutants on Aquatic Life)	W80-03661--03666 03669--03694 03696--03706	43
Information Planning Associates, Inc.	W80-03639 03648--03657 03776 03778--03779	14

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (Continued)		
Ocean Engineering Information Service (Outer Continental Shelf)	W80-03895--03899	5
Ocean Engineering Information Service (Patents)	W80-03604, 03610 03647	3
Office of Water Research and Technology	W80-03749--03750 03772	3
U. S. Geological Survey	W80-03752--03758 03760--03771	19
University of Massachusetts (Wetlands)	W80-03835 03861--03872 03874--03876 03878--03879 03881--03882	20

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Subject Fields

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6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX

ABSTRACT SOURCES

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